3rd International Conference on Energy and Environment 2007

C o n t e n t s

Section 1. RENEWABLE ENERGIES

Section 7. HYDRO-POWER ENGINEERING AND WATER MANAGEMENT

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

SOLUTIONS FOR REDUCING DISSOLVED HYDROGEN SULPHIDE IN THE BLACK SEA BY ELECTROCHEMICAL OXIDATION

Adrian CIOCANEA, Sanda BUDEA, Gabriel RADULESCU

Anaerobic disintegration of organic matter has a particular phenomenon in the Black Sea because of the set up of deposits of hydrogen sulphide - H2S having big concentration. The reason of these deposits is the absence of upward streams at depth over 100 meters. In Black Sea there are under oxic layer placed between rough. 50 and.200 meters from witch begin anoxic layer. If the equilibrium in Black Sea is not guarded, it's possible an ecological disaster. The first signals will be observed in surface waters, than, if the equilibrium is further on disturbed the depth sulphides and the hydrogen sulphide can developed to inflammable phases and even explosive. This paper presents some solutions to reduce the hydrogen sulphide from Black Sea making accent on electrochemical method.

Key words: dissolved hydrogen sulphide, electrochemical oxidation, Black Sea, in-situ process, H_2S fuel cell.

MICRO WIND POWER TURBINE WITH EXTENSION OF THE MAXIMUM ADMISIBLE WIND SPEED

PETRU BEDROS NAIANU, GHEORGHE MIHAI MIHAIESCU, SERGIU NICOLAIE.

Abstract:Technical aspects of mechanic resistance of wind turbine blades, specially due to centrifugal and aerodynamically forces at high speed, as well as in correlation with power of electric generator, are usually determinant in limitation of wind speed at level of 10 -13 m/s. This paper presents an unconventional concept and some theoretical aspects of a micro wind power turbine with modular electric generator and sequential coupling of this module.

Conclusion: this solutions, materialized through an experimental model, permit to revaluate the performances at higher wind speed, without pass dangerous peripheral speed of the wind rotor turbine

Keywords: Mycro wind turbines, Unconventional electric generator

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

WAVE ENERGY OF THE ROMANIAN COASTWISE

Mircea DEGERATU, Georgeta BANDOC, Nicolae ALBOIU, Liviu HASEGAN

Considering the actual tendency in using at a large scale of regenerative energies, in the last years a great intense was represented by the energetic wave potential and the capture, conversion and utilization of this kind of energy. The paper refers first of all to the wave characteristics in the Romanian costal region described by the simple frequency of appearance on height and period ranges of the waves. Secondly, the potential and total unit energy repartitions on height and period wave intervals in the Romanian costal region were described in the present paper. Wave characteristic and energy repartition as a function of those characteristics for the Romanian costal region are very important for the selection of the energy collector device type and also for the optimum designing of the component elements for an efficient capturing of the wave energy.

Keywords: wave frequency appearance, wave height, wave period, wave potential energy, wave total energy.

VALORISATION DES BIOCARBURANTS DANS LES MOTEURS A COMBUSTION INTERNE

Anamaria CONSTANTINESCU, Michel FEIDT, Adrian BADEA

Abstract: The proposed paper is in align with biomass energetic recovery research thematic as alternative energy source. We study the different biofuels issued from biomass and their utilization in internal combustion engines.

The paper presents some modeling results of the thermodynamic combustion processes inside the engine cylinder fueled with gasoline, biofuels, or, in different proportion with gasoline –biofuels blends.

The modeling results allowed a comparison of the biofuels (bioethanol, biogas, biogazole) influence upon the engine architecture and upon the effluents.

Résumé : L'article s'inscrit dans la thématique de recherche reliée a la valorisation énergétique de biomasse comme source énergétique alternative. On étudie les différents types de biocarburants produits à partir de biomasse et leurs utilisations dans les moteurs à combustion interne.

Le travail présente quelques résultats de modélisation des processus thermodynamiques de combustion dans le cylindre du moteur qu'utilise essence,

biocarburants ou un mélange essence – biocarburant (bioéthanol) en diverses proportions.

L'extension des résultats de modélisation doit permettre une comparaison de l'influence des biocarburants (bioéthanol, biogas, biogazole), sur l'architecture du moteur et sur les effluents.

Mots clef: biomasse, biocarburants, bioénergie, moteur, combustion.

PRIVATE INVESTMENT FOR BUILDING A SMALL HYDROPOWER PLANT AT ZETEA DAM BASIS

Florica POPA, Adina PARASCHIVESCU, Aurelia VLADESCU, Bogdan POPA

Zetea water management project comprise an earth gravity dam, made out of local materials, having as main purposes water supply, flood control and protection against flooding. The paper analyzes the possibility of building a small hydropower plant at the basis of the dam, using private investment resources, in order to put to good use the water flow evacuated from the storage lake.

Keywords: hydropower, small hydropower plant, economic analysis, investment.

LIFE CYCLE ASSESSMENT OF HYDROGEN ENERGY PATTERN

Lynda AISSANI, Patrick ROUSSEAUX, Jacques BOURGOIS, Laurent PERIER CAMBY, Philippe SESSIECQ, FLorent JABOUILLE, Sébastien LOGET

Keywords: Life Cycle Assessment, Hydrogen energy

OPTIMIZING THE OPERATION OF BIOGAS PLANTS

Gheorghe BARAN, Corina Alice BABUTANU, Florentina BUNEA, Gabriela OPRINA, Lucian MÂNDREA

The flow sheet and the operation of biogas plants from animal farms must assure: best parameters of methane-genesis process, quantity and quality of feed stock, efficiency of anaerobic digester and minimum energy consumption. The energy balance includes energetic value of the digested sludge, which is a natural fertilizer.

Keywords: biogas, anaerobic digester, hydrodynamics

ENERGY PERFORMANCE OF THE BIOMASS GASIFICATION PROCESS

Paolo BAGGIO, Marco BARATIERI, Maurizio GRIGIANTE

In this paper the biomass gasification process has been analyzed taking into account the thermodynamic constraints and considering the inherent limits of some possible small-scale processes. A multiphase thermodynamic equilibrium approach has been used to estimate the gas composition and the yield of char for partial oxidation and steam gasification. To obtain a reliable estimate of the thermal efficiency of a real process, a global analysis taking into account the whole balance of plant has been performed, supplementing the chemical equilibrium thermodynamic analysis used for the reacting stages with an evaluation of the enthalpy and exergy fluxes arising from the other plant components.

Keywords: biomass, gasification, cogeneration.

USING RENEWABLE SOURCES IN THE PULP AND PAPER MILLS

Aneta HAZI, Gheorghe HAZI

The pulp and paper industry is a major consumer of natural sources (wood) and energy (fossil fuels, electricity) and a significant contributor of pollutant discharges to the environment. In this paper there are presented pulp and paper making process and steam and power generation using renewable sources. This paper includes also an exergy analysis of the steam and power generation process for a pulp and paper mill. Based on the analysis, two sustainability indicators were calculated: the exergetic efficiency and the exergy renewability.

Keywords: black liquor, bark, exergy efficiency

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

OPTIMIZATION OF A SOFC SYSTEM: INFLUENCE OF DESIGN AND OPERATION PARAMETERS ON SYSTEM EFFICINCY

Umberto DESIDERI,Gheorghe LAZAROIU ,Pilar LISBONA, Dana RADOI

In this paper, a model for a solid oxide fuel cell (SOFC) system for decentralised electricity production has been developed and studied. The proposed system, fuelled with natural gas, consists of planar anode supported fuel cells and a balance of plant (BoP) which includes gases supply, fuel processing, heat management, start-up equipment, power conditioning and control system. A reference case has been evaluated by the use of a simple system flowsheet and state of the art operation parameters. The optimization of the electrical efficiency in the system has been carried out varying some of the operation parameters. Fuel utilization, gas temperature spring in fuel cell stack, anode off-gas recirculation, air inlet temperature and external pre-reforming reaction extent are tuned to reach the highest system efficiency.

THE ENVIRONMENTAL ASSESSMENT OF THE WOOD COMBUSTION

Cristian DINCA, Adrian BADEA, Tiberiu APOSTOL

In this paper, the authors analysed the emissions from residential boilers fired with wood logs, bark pellets, wood briquettes and wood pellets. Three boilers, selected with respect to age, design, connection to heat storage tank, and type of biofuel, were included in the study. The emissions collected comprised carbon monoxide (CO), carbon dioxide (CO_2), oxygen (O_2), total organic carbons (TOC), nitrogen oxides (NO_x), polycyclic aromatic hydrocarbons (PAC) and 33 volatile organic compounds (VOC).

We have used the Life Cycle Inventory method in order to identify the main stressors generated by the wood combustion stage. In this purpose, we have analysed one type of old boiler, one type of modern boiler and a multi-fuel boiler, which can burn wood logs, bark pellets, wood briquettes and wood pellets. In this article, we selected only the wood combustion stage because it's the most important according to the emissions produced.

Keywords: briquettes, pellets, combustion, LCA.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

CAPITALIZATION OF RENEWABLE ENERGY SOURCES: ROMANIAN CASE STUDIES

Mihai – Marius VORONCA, Mihai CRUCERU

One of the major challenges of the recent integration of Romania in the European Union is the extension of use, at national scale, of Renewable Energy Sources (RES). Targeting private operators and municipalities, authors have as objective to deliver an investigation on the interesting 'Acquis' in financing and implementing RES projects in Romania. Using as method of investigation the accurate screening of their experience as well as the extended international experience in the field, authors have reviewed in the present paper different possibilities in RES investment financing, frequent obstacles and barriers, and ways for overcoming them. Recent results are motivating authors to consider the national experience of an encouraging success and to act towards the capitalization of such investments replication potential to a national and regional scale.

Keywords: Investment, loan, cash flow, savings, profitability

DYNAMIC MODEL USED TO INVESTIGATE THE INFLUENCE OF OPERATING CONDITIONS ON THE BEHAVIOR OF COMMERCIAL PEMFC

Gabriel Lazaro PAVEL; Michele CALI; Adrian BADEA; Massimo SANTARELLI; Paolo SPINELLI; Pietro ASINARI; Carlotta FRANCIA.

Numerical modeling plays an important role in the development and the improvement of fuel cells. This paper presents a model which is used to analyze and to understand the behavior of a commercial Proton Exchange Membrane Fuel Cell (PEMFC) under variable operating conditions. These working conditions will also be investigated by means of properly designed experimental tests, which involve different electrical polarization situations.

The study of fuel cell behavior in transient conditions gives information and suggests strategies for fuel cell optimization. Nowadays many numerical models are available to describe steady state behavior but models capable of predicting transient phenomena are very few. The dynamic model discussed in this paper is used to investigate the cell behavior (voltage variations over current density, i.e. dynamic polarization curves) for different cell temperature, species stoichiometry, species inlet temperature and humidity.

Experimental tests will consist in the study of the dynamic polarization curve which gives information on fuel cell behavior at different operating conditions. The main factors affecting the performance of a commercial fuel cell will be analyzed.

The design of experiments (DOE) technique will lead us to the development of some regression models which can accurately reproduce the influence of each parameter over the fuel cell voltage and consequently to estimate the combined effects.

The regression models can also be used to check the results of the numerical models. Numerical modeling is essential in order to reduce the experimental time required to predict a complex system behavior in unsteady operating conditions and hence to reduce the economical impact of such investigation in the industrial context.

In the present paper, the numerical simulation results are compared with those due to the experimental results and the main conclusions are pointed out.

Keywords: PEM fuel cell, mathematical modeling, ANOVA

A MULTI-AGENT GENETIC ALGORITHM FOR THE SOLUTION OF THE ECONOMIC DISPATCH PROBLEM

Irina CIORNEI, Elias KYRIAKIDES

This paper presents the application and comparison of classical and heuristic methods which solve the economic dispatch (ED) problem, such as the Lagrange multipliers method (LM), genetic algorithm (GA) and simulated annealing (SA). An analytical and empirical comparison among these methods is performed with consideration to the problem formulation and its complexity and ruggedness. In addition, we propose an improved genetic algorithm with ant strategy (GAAPI) method in order to make the search more robust for economic dispatch problems that involve nonsmooth cost functions. The GAAPI method involves a multi-agent search in the solution space inspired from ant colony optimization techniques. For large systems, where many heuristic algorithms are time consuming, we propose a nearest neighbour (NNei) method to generate the starting solution for the GAAPI algorithm and to obtain near optimum global solution with a small computational time.

Keywords: economic dispatch, genetic algorithm, ant colony, nonconvex optimization, GAAPI

ENERGY EFFICIENCY APPROACH OF THE CLEAR WATER SYSTEMS REHABILITATION

Mircea GRIGORIU, Doina Cornelia DINU , Gheorghe CIOBANU

The paper aim to demonstrate the actual challenging facing the municipal companies in the last years, taking into account the consumers behavior and

composition, and the costs trends. The work emphases the new ways that should be adopted in the pumping network design rehabilitation consistent to the classical design methods. In the same time, this approach represents a new stage for the effectiveness of pumping networks design. The paper offers two categories of results: (1) general result, consisting in the elaboration of a practical method for the water networks rehabilitation design; (2) particular result, consisting in applying the method for a concrete situation.

Key words: pumping system, consumers behavior, energy efficiency

MODELLING AN AIR-CONDITIONNING PLANT WITHIN THE TRNSYS ENVIRONMENT

Andrei DAMIAN, Iolanda COLDA, Catalin TEODOSIU

Abstract – In the frame of the world energy crisis observed in the last decade, the task of reducing primary energy resources (gas, oil and fossil fuels) became an essential goal of many countires. The actual preoccupations are focusing on the building sector, which has been shown as a high energy consumer for the whole energy market. Moreover, in the field of HVAC systems equipping the buildings, the air-conditionning systems showed themselves as one of the highest energy consumers. In the light of these assumptions, the scope of the present paper was to calculate the energy consumptions linked to an air-conditionning plant of "all-air" type equipping a commercial store in Oradea, Romania. These calculations were performed by means of numerical simulations with the TRNSYS software, which enabled us to simulate the majority of the building thermal transfers, as well as the air-conditionning and regulation equipments. We used TRNSYS due to its complexity, its continuous development and its conformity with the actual reglementations related to the EPBD (European Performance Building Directive).

The simulations results suggest some technical measures to be implemented in order to reduce the electrical, heating and cooling consumptions of the air-conditionning plant.

Keywords: air-conditionning, simulation, energy efficiency, component, singlezone

ECOLOGICAL FIRE PROTECTION MATERIALS TO INCREASE SAFETY IN ENERGY EQUIPMENTS

Lelian CIOROIANU, Gabriela CIOROIANU, Minodora LECA, Marie Jeanne POPOVICI, Gabriela DAMIAN, Catalina COSTEA, Ana Maria MATEI

Fire behaviour is a major factor which limits the use on large scale of new materials, presently being developed various materials and technologies in function

of the application field. Problems regarding toxicity and heat emission limited the expansion of new materials in sectoral and cross-sectoral applications.

The paper describes the obtaining of new fire protection knowledge based materials, high performant and cost efficient through implementing current scientific and technological knowledges in existent technologies.

Compositions of ecological fire protection materials were obtained, which include gas and nontoxic vapor supplying ingredients that expand the films under fire action and carbon supplying ingredients that insure a solid spinel structure of the foam. Inorganic charges with high thermal resistance, high specific surface and controlled concentration of active surface groups were obtained, following the influence of micro and macrostructural parameters of powders on composition characteristics.

Tests pursued the behavior of obtained films in normal functioning state and in the case of a fire. Fire behavior of ecological protection materials was determined through reduced scale tests, obtaining fire resistances greater than 60 minutes and 2000-5000% expansion indexes.

Keywords: fire protection, thermofoaming coatings, ecological.

ENERGY AND EXERGY ANALYSIS OF HOT WATER DISTRIBUTION NETWORKS

Carmen Ema PANAITE, Aristotel POPESCU, Daniela POPESCU

In the present paper, energy and exergy losses corresponding to a hot water distribution pipeline were evaluated. For this purpose, mathematical models and computational programs were proposed. To improve the accuracy of the numerical results the effect of friction on the temperature drop was considered. The analysis of the influence of the inlet water temperature and of the mass flow rate was developed and conclusions regarding the operational conditions in district heating networks were formulated.

Keywords: Energy losses, exergy losses, hot water network.

SYSTEM OF DATES ACQUISITION FOR THE TEMPERATURE MONITORISING AT THE INDUCTION HEATING FOR THE STICKING OF THE CONNECTION IN ELECTRICAL MACHINES COILS.

Dragos ANGHEL, Catalin DOROS, Felicia ANGHEL,Razvan BARBIERU

Monitorising the temperature for heating through induction for pasting the connection of the coils of the power electrical machines, is offering the possibility to optimize the technological process. In the present paper are presented solutions for data acquisition in two variants: Measuring temperature up to 125° C using DS1620 and measuring temperature from 250°C up, using DS 2760 circuit and a thermocouple. Is also presented the practical realization for the first part.

Keywords: acquisition, temperature, monitorising, electrical, machines.

METHODS FOR SIMULATING HEAT CONSUMPTION

Daniela POPESCU, Florina UNGUREANU, Dorin IVANA, Nicolae BUTNARU

One major area of saving energy and resulting financial expenditure is the ability to simulate the heat consumption of buildings, in order to match supply to demand. This work presents development and exploitation of two mathematical models based on statistical methods and artificial neural networks for analyzing and predicting the heat consumption of buildings connected to a district heating system. The validation of the methods was performed by comparing the modeling results with acquired data via a monitoring system from the District Heating Company of the city of Iasi.

Keywords: district heating network, simulation model, prognosis.

INVESTMENT PORTFOLIO AND PORTFOLIO INVESTMENTS FOR A SUSTAINABLE DEVELOPMENT

Mihai – Marius VORONCA, Roxana DUMITRESCU, Anca FODI, Adrian MARIN

The Romanian Energy Efficiency Fund (the Fund) is a financial institution (FI), specialized in commercial co-financing of investments in rational use of energy (RUE) and renewable energy sources (RES). The Fund was created through the common initiative of the Romanian Government and the World Bank. Targeting the

involvement of the banking sector in commercial co-financing of such investments, the Fund has continuously managed a well-balanced projects' and clients' portfolio.

Base on it, the Fund has reported by the end of 2006 excellent financial results and marked significant steps towards a consolidated self-sustainability. Authors intend to present, in exclusivity for Romania, a realistic assessment of investment portfolio and two portfolio investments with impact upon the Romanian Energy Efficiency

Fund self sustainability and market position, as well as upon perspectives of further institutional development.

Keywords: Financing, investment, loan, cash flow, profitability, sustainability

ASPECTS REGARDING FOULING OF STEAM CONDENSER - A CASE STUDY

Roxana GRIGORE, Adrian BADEA

The paper makes a point to effect of fouling to steam condenser. The performance of the steam condenser is directly affected by fouling. It is presented a case study of a condenser of steam turbine DSL 50-1. In the paper are calculated the basic design heat transfer coefficient, the effective heat transfer coefficient and the fouling resistance of condenser. The study shows a presence of tube fouling or the presence of excessive amounts of air within the shell side of the condenser. The conclusions of the study is that the real variation of condenser fouling resistance in time is allied to variation presented in literature like saw-toothed fouling and for the studied condenser it is necessary to realize a correct maintenance policy.

Keywords: fouling resistance, heat surface, basic design heat transfer coefficient, effective heat transfer coefficient, steam condenser

ECONOMIE D'ENERGIE PAR STOCKAGE DU FROID

Constantin IONESCU, Horia NECULA, Adrian BADEA

Thermal energy storage has recently attracted increasing interest related to the thermal applications such as the cooling and the air-conditioning of the buildings. The energy storage is essential whenever there is a mismatch between the supply and consumption of energy. In the first part of this paper the general concepts concerning cold storage and the situations when the implementation of such system is feasible, are presented. Further, the strategies employed for cold storage are compared. A presentation of the fluids used for the storage of cold with

their advantages and disadvantages is also made. Finally, an evaluation of energy saving related to the use of a cold storage system is carried out.

Le stockage d'énergie thermique a récemment attiré l'intérêt croissant lié aux applications thermiques telles que le refroidissement et la climatisation des bâtiments. Le stockage d'énergie est essentiel quand il y a une disproportion entre l'alimentation et la consommation de l'énergie. Dans la première partie de ce papier les notions générales concernant le stockage du froid et les situations quand l'implémentation d'un tel système est faisable, sont présentés. Suite, les stratégies employée pour le stockage du froid sont comparés. Une présentation des fluides utilisés pour le stockage de froid avec leurs avantages et inconvénients est aussi faite. Finalement, une évaluation d'économie d'énergie réalisée par l'utilisation d'un système de stockage de froid est réalisée. Economie d'énergie par stockage du froid est belle.

Keywords: thermal energy storage, energy saving, storage strategy, cooling load.

LOAD PROFILING FOR THE ELECTRICITY MARKET

Virgil DUMBRAVA, Gabriel BAZACLIU, Theodor MICLESCU

In this paper the load profiles used by different entities (distribution utilities, suppliers) on the electricity market have been analysed. Load profiles are necessary for utilities from cost of service and rate design to load management and forecasting to settlement. Principal applications for retail suppliers include pricing, cost analysis, planning and assessment of load management, load scheduling and market settlement. Following some methods used to load profiling are presented, together with a case study done according with the Romanian procedure for load profiling.

Keywords: load profile, electricity market, case study.

A MICROTURBINE MODEL INCLUDING ITS CONTROL FOR THE INVESTIGATION OF THE EFFECTS OF DISTRIBUTED GENERATION IN DISTRIBUTION NETWORKS

Samuele GRILLO, Stefano MASSUCCO, Andrea MORINI, Andrea PITTO, Federico SILVESTRO

The paper proposes a detailed model of the thermal and mechanical part of a microturbine; in fact this model accounts for three control loops: a speed controller (for primary frequency control), an acceleration control loop, which limits the rotor acceleration in case of sudden loss of load or in case of start-up, and a controller

which limits the temperature of the exhaust gases below the maximum admissible temperature.

Moreover the paper adopts a PV (active power – voltage) control of the inverter for the microturbine operation on the grid; the usual scheme adopted is a PQ (active power – reactive power) control, which regulates the values of active and reactive powers injected by the inverter into the grid. The use of a PV control scheme allows to evaluate the contribution of microturbines to voltage support in distribution grids. In case of isolated operation a Vf (voltage – frequency) scheme is adopted. A test grid is implemented and the results of the simulations are described and discussed.

Keywords: distributed generation, microturbines, active and reactive power controls, voltage and frequency controls.

IDENTIFYING PLAUSIBLE CASCADING EVENTS IN SYSTEM STABILITY ASSESSMENT

Bogdan OTOMEGA, Thierry VAN CUTSEM

An implementation of the event tree approach is proposed to determine possible sequences of cascading failures with severe impact on a given power system. The algorithm takes into account protection systems hidden failures and transmission system equipments overload. At each level of the event tree development, the sequence probability order is computed and a filtering tool is used to identify possible harmful sequence. These are furthermore analysed with a time domain simulation tool in order to assess their impact on the power system. This paper contains the description of the event tree algorithm as well as examples of its practical application on the Nordic32 test system.

Keywords: cascading failure, hidden failure, event tree.

OPTIMAL PLACEMENT OF FACTS DEVICES BY EVOLUTIONARY MULTIOBJECTIVE OPTIMIZATION

Daniel RADU, Yvon BESANGER

Abstract— The present paper is focused on Flexible AC Transmission Systems (FACTS) devices. The central technology of FACTS involves high power electronics, a variety of thyristor devices, microelectronics, communications and advanced control centres. FACTS, is a superior option, from technical and environmental points of view, to increase the utilization and stability of a transmission grid. Our preoccupation has to develop a strategy for the optimal placement of FACTS devices into power systems. Regarding the technical aspect of

FACTS insertion in power systems and also their high investment cost, a multi-objective optimization technique is developed for solving this problem. We employed Multi-Objective Genetic Algorithms based approach (MOGA), which is used to characterize the Pareto Optimal Frontier (non-dominated solutions) and to provide to Decision Makers and engineers insightful information about the trade-offs to be made. In this paper two technical and economical objective functions are considered: maximization of system security and minimization of investment cost for FACTS devices. The optimization process is focused on three parameters: the location of FACTS in the network, their types and their sizes. For these proposals we employed a hybrid software developed in Matlab™ which uses the EUROSTAG™ software for load flow calculations. The developed MOGA are successfully tested on an IEEE 14-bus power system.

OPTIMAL REACTIVE POWER FLOW METHODOLOGY IN POWER SYSTEMS WITH SECONDARY VOLTAGE CONTROL

Ilea VALENTIN, Alberto BERIZZI, Eremia MIRCEA

The voltage - reactive power control in the transmission networks has become a major problem in recent years. The Hierarchical Voltage Control System (HVCS) represents one of the best alternatives to the traditional voltage control. The paper focuses on the implementation of an Optimal Reactive Power Flow (ORPF) methodology in power systems with Secondary Voltage Control (SVC). To achieve this, the mathematical model of the optimization problem was studied considering two major aspects: establishing the constraints of the objective function in order to fulfill the actual operating condition of the SVC system and to avoid the power system equipments reaching their technical limits and, on the other hand, finding the proper objective function. The mathematical model was implemented in AMPL and simulations were performed on a power system with SVC.

Keywords: hierarchical voltage control, optimal reactive power flow, security and economy.

OPTIMAL RECONFIGURATION OF THE DISTRIBUTION NETWORKS IN UNCERTAINTY CONDITIONS

Gheorghe CARTINA, Gheorghe GRIGORAS

A method based on the hierarchic clustering techniques, conjunctively with fuzzy modeling, is presented in this paper for improving of the fuzzy models and the estimation of the power losses. Numerical results obtained with many tests

demonstrate the ability of the improved fuzzy models to overcome difficult aspects encountered in optimal reconfiguration process of the large distribution networks.

Keywords: optimal reconfiguration, power losses, distribution networks, clustering techniques, fuzzy models.

GEOGRAPHIC INFORMATION SYSTEM (GIS) – AN INTEGRATED TECHNOLOGY FOR DISTRIBUTION SYSTEMS ANALYSIS

Gheorghe GRIGORAS, Gheorghe CARTINA, Virgil ALEXANDRESCU

Utility companies and system operators perform power system analysis for planning and operation of their systems. The evolution of the computer and Internet technology have created a flood of information, and the amount of information about power system analysis models and results seems to outrun the ability of people to utilize it.

In this paper it is presented a tool for power system analysis that interfaces with geographic information system (GIS).

Keywords: GIS, distribution systems, power analysis.

ENERGETIC SUSTAINABLE APPLICATIONS IN RAILWAY STATIONS

Roberto FARANDA, Sonia LEVA

The present paper analyses the possible integration of the railway station power supply with photovoltaic panels and the contact line. In order to reduce the environmental impact and limit the use of the ground, the panels are integrated in the shelters using architectonic photovoltaic panels.

The objective of this paper preliminary technical/economic analysis and the calculation of the surface of the photovoltaic panels necessary for the electrical load supply in relation to the various typologies of railway station as well as considering the possibility or not to sell the energy as defined in the Conto Energia Italian financing scheme.

Keywords: Photovoltaic system, Hybrid System, Renewable, Railway Station.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

COMPARATIVE STUDY OF TEN MAXIMUM POWER POINT TRACKING ALGORITHMS FOR PHOTOVOLTAIC SYSTEM

Roberto FARANDA, Sonia LEVA, Vincenzo MAUGERI

The output characteristic of a photovoltaic array is nonlinear and changes with solar irradiation and the cell's temperature. A Maximum Power Point Tracking (MPPT) technique is needed to draw peak power from the solar array in order to maximize the produced energy. This paper presents a comparative study of ten widely-adopted MPPT algorithms; their performance is evaluated using the simulation tool Simulink®. In particular, this study compares the behaviors of each technique in the presence of solar irradiance variations.

Keywords: Maximum power point (MPP), maximum power point tracking (MPPT), photovoltaic (PV).

DG PARK: SYSTEM AND CONTROL OPTIMIZATION FOR IMPROVING POWER QUALITY

Morris BRENNA, George Cristian LAZAROIU, Gabrio SUPERTI-FURGA, Enrico TIRONI

Abstract: the present paper introduces and investigates a particularly important topic in the field of distributed generation applications: the dc power delivery. Direct current distribution systems can represent a very interesting opportunity for connecting low voltage commercial and residential loads to distributed generators, especially if they belong to the renewable energy family. The proposed dc grid requires an optimal control strategy for obtaining the best performances of the system. The paper deals with the proposal of a dc distribution system layout and with the control logic that can achieve the best performances for ensuring a high degree of supply continuity to the customers sensitive to power quality disturbances.

Key words: power quality, distributed generation, dc distribution

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

ARTIFICIAL NEURAL NETWORKS APPLICATIONS IN DYNAMIC SECURITY ASSESSMENT OF POWER SYSTEMS

Constantin BULAC, Mircea EREMIA, Ion TRISTIU, Andreea ERBASU, Bogdan OTOMEGA

In the dynamic security assessment of power systems, the critical clearing time – CCT is one of the parameter of paramount importance. It constitutes a complex function of the pre-fault system operations conditions, fault type and location and post fault conditions that themselves are dependent on the protective relaying strategy employed. The evaluation of CCT involves elaborate computations that often include time-consuming solutions of non-linear algebraic and differential equations. From the point of view of on-line implementation of CCT assessment, this presents a major difficulty. Application of artificial neural networks – ANNs is a promising alternative. High adaptation capabilities of ANNS enable them to readily synthesize the complex mappings that transform input attributes or features into the single valued space of CCTs. In this paper we examine the generalization capabilities of layered feedforward neural network – LFNN, focusing on their ability to deal with a large range of operation regimes in power system. For CCT assessment, each generator is represented by three features, which can be derived from the measurable parameters of power system. The effectiveness of the proposed neural network based approach is demonstrated on the Test2 system with 13 buses, 5 generators, 15 lines and 8 loads.

Keywords: dynamic security, critical clearing time, artificial neural networks.

MULTI-CRITERIA ANALYSIS FOR OPTIMAL PLACEMENT OF DISPERSED GENERATORS IN DISTRIBUTION ELECTRIC NETWORKS

Ion TRISTIU, Mircea EREMIA, Constantin BULAC, Lucian TOMA

The paper presents an analysis on the optimal placement of dispersed generators within the distribution networks. The objective function is multi-criteria and consists of the cost of power and energy losses in a distribution network as well as the cost of customer interruptions. By minimization of this function, an optimal number of dispersed generators as well as their rated powers are achieved. The constraints taken into account in this optimisation problem is related to the nodal voltage level and the thermal limit of the network branches. A medium voltage distribution network is used to test the proposed optimisation model.

Keywords: distribution networks, dispersed generation, power losses, energy losses, reliability.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

APPLICATION DU CONCEPT DE LA SOCIÉTÉ À 2000 WATTS À UN PROJET DE QUARTIER URBAIN

GAËTAN CHERIX, JEAN-MARC REVAZ, NICOLAS DE LIMA

17 500 kWh : telle est la moyenne mondiale annuelle de la consommation énergétique par individu. Ce chiffre correspond à une puissance continue de 2 000 Watts. En Suisse, la consommation actuelle est deux fois et demi plus élevée, c'est à dire de 5000 watts par personne, tandis qu'elle se monte à 6000 watts par personne en Europe de l'Ouest. En moyenne, les hommes et les femmes de certains pays d'Asie et d'Afrique n'utilisent qu'une partie infinitésimale de cette consommation. La vision de la société à 2 000 Watts permettrait de réaliser un équilibre entre les pays industrialisés et ceux en voie de développement [Novatlantis, 2005]. Deux objectifs sont à mettre en avant, limiter la consommation d'énergies fossiles à 2 000 Watts par personne pour le logement et la mobilité et les émissions de CO_2 à une tonne d'ici 2050.

La Ville de Martigny a récemment décidé de réaliser un avant-projet urbain de réhabilitation d'une ancienne friche industrielle. Le projet est de réaliser un quartier résidentiel d'une vingtaine de bâtiments de tailles et d'affectations différentes dont la surface dépasserait les 35 000 m_2. La dimension de ces infrastructures va naturellement entraîner une importante consommation de ressources. La consommation d'énergie se montera, par exemple, à environ 3 000 000 kWh (condition SIA standard [1], 84 kWh/m_2.an) uniquement pour le chauffage des locaux. Fort de cette constatation, les élus locaux ont décidé d'analyser en détail la problématique énergétique/climatique, en s'appuyant sur : la vision 2 000 Watts.

Pour atteindre cet objectif de consommation, il est nécessaire d'une part d'utiliser des technologies nouvelles et efficientes. D'autre part, de modifier le comportement des usagers en favorisant le transfert des transports individuels (voitures, motos, etc.) vers les transports publics.

Le projet réalisé est complexe. C'est pour cela qu'il est concentré sur les opportunités de réduction de consommation liées aux bâtiments, en considérant la totalité des consommations engendrées (électricité, chaleur, froid). De ce fait, la solution d'approvisionnement et d'utilisation des ressources dans ce nouveau quartier a été minutieusement analysée. Le but est de minimiser l'utilisation des ressources (énergie primaire) et les impacts environnementaux (CO_2), tout en garantissant une qualité de vie optimale.

Mots-clés : système énergétique complexe ; société à 2000 watts**.**

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

TRANSMISSION NETWORK EXPANSION PLANNING USING GENETIC ALGORITHMS

Ioana PISICA, Gareth TAYLOR

This paper presents a Genetic Algorithm (GA) approach to the transmission network planning problem in electric power systems (TNEP).

The TNEP problem seeks to determine when and where new circuits are needed and should be installed to serve, in an optimal way, the growing electric energy market, subject to a set of electrical, economic, financial, social and environmental constraints. This problem has a dynamic nature, since the requirements of transmission facilities (lines or power transformers) should be defined over time within a given horizon.

On the other hand, the transmission expansion planning can also be done in a "static" way, where the planning is performed for the horizon year, with the goal of determining the reinforcement needed for this specific year only (STNEP).

This paper deals with the static approach, the dynamic one being a more complex topic, beyond the scope of this research. In spite of being simpler than the dynamic planning, the static planning is still very complex, and research has been stimulated worldwide to develop computational tools to facilitate the solving of this task. This is a very large – scaled, mixed integer mathematical programming problem that frequently presents many local, sub – optimal solutions, and for which the number of possible solutions grows exponentially with the network size. The objective of this problem is to determine the most economical planning scheme(s) to meet the load demand in the horizon year subject to the security or reliability constraints.

The STNEP problem and its mathematical modelling are briefly described.

The proposed Genetic Algorithm is applied to a reference electric system for which the solution is known and its performance is compared against classical solution methods.

Keywords: transmission network planning, genetic algorithms, static planning.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

ECONOMIC ESTIMATION OF CUSTOMERS POWER QUALITY PERTURBATIONS

G. ESPOSITO, N. GOLOVANOV, G. C. LAZAROIU, D. ZANINELLI

ABSTRACT: The liberalization of the energy market determined the growth of customers concerns supplied by various utilities regarding the quality of services provided. The customers became more conscious and better informed about the impact of electromagnetic perturbations on the electrical equipments and technological processes (inclusively on the quality of the final product) and, as a result, requested to the utilities to provide the electrical energy within the contracted power quality indices limits. Economic losses determined by interrupted manufacturing, damage of equipments, products of poor quality and time delays have raised the number of consumers not satisfied about the power quality degree. The level of these damages depends on the amplitude of the residual voltage and on the duration of the perturbation. The paper deals with the survey of the supply continuity for customers connected to a medium voltage Italian feeder, and the estimation of the costs associated with these power quality disturbances. Starting from a certain acceptable level of the economic damages, a probabilistic method for estimating the admissible values of the power quality indices associated to supply continuity is presented.

Keywords: power quality, supply continuity, cost estimation

MATERIALS WITH LOW ENVIRONMENTAL IMPACT TO BE USED IN ELECTRIC POWER ENGINEERING

Bogdan NICOARA, Marian COSTEA

***Abstract**: Electric power installations have no significant environmental impact concerning chemical pollution, in normal operation conditions. But the manufacturing procedures used to obtain electrotechnical materials require, normally, large energy consumption, expensive raw materials and emit noxious by-products, all of them with harmful consequences for the environment. The paper analyses the features of the most used electrotechnical materials in order to assess their environmental impact. Another threat for environment and living beings is the accidentally leakage of certain liquid or gaseous insulations during transport or in operation of equipment. To avoid the environmental impact of these insulations, some alternatives are proposed such as biodegradable oil, hexafluoride-nitrogen mixtures or vacuum. The main features of these new materials are presented, in order to justify the preference for them in a near future, when the acceptation criterion to use a certain material will be, certainly, the level of environmental impact. Referring to Romanian power transmission lines the quantities of the most used materials were estimated and also the benefits for recycling them.*

Keywords: electric power engineering, recycled materials**,** insulating biodegradable oil, sulphur hexafluoride-nitrogen mixtures.

TO THE PROBLEM OF FREE GAS FLOW MODELING IN THE ENERGY EFFICIENT STOVE FOR PRIVATE HOUSE AND OFFICE

Alexey BOBKOV, Ivan KAZACHKOV, Igor KUZNETSOV

The novelty of the well-known in the world heat generators built on a principle of "free gas movement" lies in the organization of fuel combustion in the bell. The paper is devoted to study the processes of the heat and mass transfer inside the combustors with detail measurements of the temperatures, flow rates, etc. in different parts of the system to optimize its parameters and to build the strong theoretical backgrounds with mathematical modeling and simulation. The computer simulation code is developed and tested for the investigation of any particular case and for the optimal stove construction by the stated request (functionality, productivity, fuel type, etc.). The computer code allows getting the drawings for the masonry that is going to build the stove in each particular case. The heat generators with a system of a free gas movement invented by Igor V. Kuznetsov (http://www.stove.ru) have shown the highest effectiveness in the world (up to 90%). Many of them having diverse functionality and construction were built and successfully implemented for private houses and small offices in USA, Canada, and Europe. Presently such type of energy efficient ecologically clean stoves is demanded in the EU countries including Norway, Finland, Sweden, Denmark, etc. Customers request an optimal construction in each particular case and ask for basics about the thermal hydraulic processes in a free gas movement system and about the constructing and building the stoves, as well as about their use. The paper answers some of the questions and describes the basic features of the new effective stoves. The problem of the free gas movement modeling in the stoves is considered in the paper as the one of the most important for optimization of the stoves, for increase of the stove effectiveness and for their computer design.

Keywords: stove, modelling, free gas movement, ecologically clean, effective.

THE INFLUENCE OF FLUE GAS DESULFURIZATION IMPLEMENTATION ON LIGNITE COMBUSTION POWER PLANTS PERFORMANCE

Adrian ALBEANU, Viorel TUDOR

Abstract: The objective of the paper is to determine the influence of Flue Gas Desulfurization (FGD) implementation on lignite combustion Power Plants

performance, in fact to reveal the operation cost impact evolution. At the beginning, are presented the main desulfurization technologies used all over the world in power plants. From these alternatives, two of the most frequently used technologies are chosen for a detailed analysis – the wet technology and the semi-dry technology.

It is presented the architecture of the structure, the function of each component and the performances for each of the two technologies. By using the Multi Criteria Analysis method for data analysis, it is processed 8 criteria (considered the most relevant criteria) for evaluation of the FGD investment impact on existing coal fired Power Plants. The results of Multi Criteria Analysis reveal the importance top of the 8 criteria analyzed. Those criteria are associated with the two FGD technologies described before, resulting which technology is most advantageous to be implemented in case of 315 MW coal (lignite) fired Unit.

Considering the results of the Multi Criteria Analysis, on the most advantageous technology is processed for this size Unit, the specific consumptions – the reaction agent consumption, the power consumptions, the compressed air consumptions, the operation personnel cost and the annual maintenance cost for this FGD technology.

After this data processing, it results a certain specific increase of the operation cost of the 315 MW Unit. This operation cost increase has to be considered by all Power Plant managers to face the impact of the environmental requirements on the operation cost of the Units.

The conclusion is that the entities involved in FGD implementation in coal fired Power Plants, can find the most important criteria in appreciation of one technology, also the top of the criteria and especially for this range of Unit size, could be seen the Unit operational cost impact of FGD.

The information is important for investors, Power Plant managers and officials which are interested in strategic development plans respecting the principle of sustainable development.

Keywords: FGD – Flue Gas Desulfurization; Multi Criteria Analysis; TPP – Thermal Power Plant

SULPHUR DIOXIDE EMISSION REDUCTION FROM POWER PLANTS - CASE STUDY

Magdalena MATEI, Lucian MATEI, Ciprian ANA, Otilia Nedelcu, Simona Mihaescu, Laura Matei, Barbara SOARE

The actual challenges of Romanian power market are the increasing of fuels prices, the insecurity of supply and the environmental degradation. The forthcoming total liberalization of natural gas prices in Romania and their trend to the European ones will conduct to an increasing of electricity price based on gas-fired power plants higher than coal-fired power plants. Also, it is expected an increasing of

electricity price due to the investments for the facilities needed to comply with environment legislation concerning the limits of SO_2, NOx and particulate matter emissions.

The paper presents a study case concerning flue gas desulphurization at a steam boiler fuelled with lignite. The paper concludes that the hybrid (semi)dry methods could not ensure the reduction of SO_2 level under the maximum level permitted according with the new Romanian legislation. The increasing of the natural gas in fuel mixture with lignite could represent a solution to comply with the new requirements.

Keywords: SO_2 emission, flue gas desulphurization, boiler, case study.

EXPERIMENTAL RESULTS CONCERNING FLUE GAS CLEANING TECHNOLOGIES APPLYING SNCR AND COMBINED METHODS

Ioana IONEL, Francisc POPESCU, Gavrila TRIF TORDAI, Corneliu UNGUREANU, Alexandru SAVU, Daniela Ionela CIOLEA, Carmencita CONSTANTIN

The research presented in this paper focuses on a facility, the experimental results and interpretation concerning the flue gas cleaning using SNCR processes in a fluidized bed combustion pilot rig. Mainly pit coal from Valea Jiului basin was used as principal fuel in fluidized bed combustion system, in order to demonstrate the efficiency of the for secondary NOx reduction.

Keywords: SNCR process, pit-coal, fluidized bed.

COMPUTATIONAL CASE STUDY OF BIOMASS COCOMBUSTION IN A PILOT FLUIDISED BED REACTOR

Paul-Dan OPRISA-STANESCU, Ioana IONEL, Vasile GRUESCU, Gavrila TRIF TORDAI, Corneliu UNGUREANU

OBJECTIVES: The aim of the paper focuses on a numerical study by means of the FLUENT code 6.2, accomplished on a pilot for co-combustion of Lignite and biomass. The novelty is developed also by the fact that the analysis is achieved not on classical pulverized combustion, but on a combination of fossil fuel with a renewable source working in a fluidized bed, and is developed on basis of results accomplished during pilot testst. The facility built at the University Politehnica of Timisoara allowing the co-combustion in fluidized bed works in the range of 25 – 50 kg/h Lignite and 15 – 30 kg/h biomass. By appropriate discreet dividing of the

combustion space in cells one succeeded, by applying the latest FLUENT code 6.2, to determine different representative distributionss. The results have been accomplished in the frame of a national Excellency project, financed by the Ministry of Education and Research, which are addressed thanks for the financial support.

CONCLUSIONS: The optimization of the combustion is possible also by innovative studies using the modeling tools for different concentrations of pollutants and other combustion products, as well as energy fields. Also modeling is a fruitful tool to compare different solutions, priorto testing.

Keywords: biomass, co-combustion, fluidized bed, CFD, FLUENT.

DESIGN & CONSTRUCTIONS OF A PROTOTYPE MODULAR SYSTEM FOR INDUSTRIAL GASES DEPOLLUTION

Viorel SERBAN, Madalina ZAMFIR, George CIOCAN, Marian ANDRONE, Ioana FLOREA, Ilie PRISECARU, George DARIE

Many of the technological processes are generating gases which contain a high quantity of solid and gaseous pollutants. The current procedures are quite well solving the problem of entrapping the solid particle type pollutants, with high costs and investments.

Entrapping and storage of CO2 and SO2 type gaseous pollutants has not been solved yet, technically and economically. The today solutions are requiring very high costs and investments and yet, they cannot be implemented.

This document presents the researches which have been developed until today in finding a new procedure to simultaneously retain both the solid and gaseous pollutants. The new solution is definitely superior in point of lower costs and investments, following that after experimental testing, the degree of retaining the pollutants, be determined.

Keywords: solid and gaseous pollutants, exhausters, centrifugal device.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

THE ENERGETIC REVALUATION, BY BURNING, OF THE COMBUSTIBLE SLUDGE RESULTED FROM THE PAPER PRODUCING INDUSTRY

Manuela Elena GEORGESCU, Vasile MATCASU

Abstract: The surrounding protection, in the present day conception, entails the development of new technologies for the revaluation of waste resulted from different industrial activities.

The paper presents the tests achieved in view of burning the sludge resulted from the paper producing industry and also the accomplishing conception of a steam-generating boiler, in order to highly energetic revaluate this sludge.

Keywords: Sludge, residue, low heat value, combustible substitute.

TECHNICAL OPTIMIZATION OF THE REGENERATIVE PREHEAT LINE TEMPERATURE GROWTH'S REPARTITION, FOR REHEAT STEAM CYCLES

Florin ALEXE, Victor CENUSA, Horia PETCU

This paper refers to high power steam units with elevated main steam parameters, steam reheat and advanced feed water preheat. For non-reheat steam cycles, an analytical demonstration, shows that maximal steam cycles thermal efficiencies are obtained for equals temperature's growths in feed water preheat stages. In reheat steam cycles, without extractions during the steam's expansion in turbine's High Pressure Cylinder, some papers recommend, in order to reduce the electricity price, a bigger temperature increase at the final preheat stage, supplied with steam from extraction amount of reheat. The paper pursue simultaneous technical optimizations, with economical consideration, of steam reheat pressure and feed water preheat temperature, with an optimal distribution of temperature's growth between the water preheat stages.

Because of the thermal scheme complexity, the great number of variables and transcendent equation involved, the study was elaborated through numerical simulation. We used validated methodologies, functions, and procedures, most of them conceived and in our chair. Simulation is performed only for stationary design load. Numerical examples that will be presented refer to usual data sets for high power steam cycles. The results demonstrate that it is impossible to maximize in the same time the thermal efficiency and the investment. An analysis taking into consideration three main criteria put into evidence that: ***a)*** *the optimal steam reheat*

*pressure is about 24 % from the main steam pressure and **b)** optimal temperature growth for the final preheat stage is 1.4□1.5 bigger then the temperature growth at the feed water preheat stages supplied with steam from extractions after reheat.*

Conclusions could be applied for new units design and existing units retrofit.

Key words: Rankine Cycle, Steam Reheat, Feed Water Preheat, Optimization, and Computation.

COMPUTER MODELING OF POWER GENERATION GAS TURBINES, ISSUED FROM TURBOJET OR TURBOFAN AIR PROPELLERS

Victor CENUSA, Florin ALEXE

*Technological transfer from aeronautic area to power sector leaded to development of a new class of medium scale power gas turbines, using as "gas generators" engines issued from turbojet and turbofan propellers. The assembly is designing on coaxial shifts, without mechanics gears between them, but coupled by the gas flow. The lack of mechanical link between shafts permits having: **a)** modular design and **b)** high and variable rotation speeds at the high pressure shaft(s). The first feature allows an easier and quickly maintenance, by replacing the gas generator. The high speed reduces the dimensions and the investment amount. In the same time it allows, for the same air / gas flowing areas, longer working profiles and higher isentropic efficiencies of rotating machines, respectively higher thermal efficiency. The variable speed improves the partial load GT performances.*

Consequently, using the aero-derivative turbojet / turbofan design could insures, in the same time, high efficiencies, low investment prices and a good reliability and availability

*The paper, based on a numeric model of gas turbine's cycles, conceived for stationary nominal load, uses procedures achieved and validated in our chair. The author's targets are determining: **a)** the equivalent Brayton cycle and their main thermodynamic and energetic data (temperatures, pressures, expansion ratios, efficiencies, specific works) **b)** the repartition of gas's expansion between the HP turbine(s) - witch drive the compressor(s) – and the Low Pressure (LP) turbine, witch drive the electrical generator, respectively **c)** the parameters at the LP turbine input. The numerical data were taken from producers directories and refer to usual medium power gas turbines. The obtained results are in concordance with references data. They show that LP turbines, driving the generators have significantly lower parameters than the usual heavy duty turbines. The conclusions could be applied, mainly, for choosing the higher thermodynamic parameters at the gas generator and coordinate their design with the LP power gas turbines.*

Key words: Power Generation, Aero-Derivative Gas Turbines, Turbojet,

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

Turbofan, Brayton Cycle, and Computer Modeling.

EXPERT SYSTEMS FOR STEAM TURBINES DRIVING

Nicolae MIHAILESCU, Sebastian ALEXIU

Thermoenergetic processes aided management, efficient and real-time, at turbogenerator level involve high rapidity feedback and more that, processes prediction to establish evolution sense to out of range function, before reach them.

So, elimination and interactive correction of errors introduces by automation elements must by continuos, so for process stability states like for transitory states, where parameters variation rapidity involve rapidity of data and errors processing. To create an efficient, fast and complex system for driving and surveillance of a turbogenerator group, or a steam turbine, involve using the computing technology and a specialised software's for data analyse and computing. That system, dedicate for an equipment is named expert system. Create, using and develop of a expert system involve to create an analyse, diagnose and prediction ensemble to be capable to oversee and co-ordinate the machine or a group of the machines and offer to user a complex view about drive process and so help and faster solve solutions, if an damage appears or if the process follow to go through out of range limit.

Characteristic expert system functions can be define as a basic collection of rules for software development. Analysis addicted software will read, process, storage, analyse and proceed so, one certain parameter from process to came information as analysed will be return back into process by execution organs or will be transform into a alpha numerical or graphical information for users. The expert system must guide the process evolution into the predicted evolution range.

Maybe the most important characteristic of an expert system, what separate it of an conventional automation feed-back system, is that the expert system will be into a continuous developing by continuously storage of malfunctions parameters and create and store, based it, new procedures to solve the problems.

Software expert system development platform consists into a collection of functions, methods and procedures that by hardware components can oversee and control the process. Software platform is a machine program process dedicate, developed under a flexible programming tool who can give possibility to modify, develop, add, or eliminate procedures and functions writes for process managing.

Case of fast evolution processes is necessary to use a multi-tasking software platform so that every stage of process can be watch.

Keywords: expert, turbine, moulding, conversion, analyse, simulation.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

THE INFLUENCE OF ENERGY DEMAND OVER THE OPTIMAL SIZING, FROM A TECHNICAL-ECONOMICAL POINT OF VIEW, OF COGENERATION PLANTS EQUIPPED WITH A GAS ENGINES

Alexandru Cosmin PAVEL

Abstract: The present paper reveals the main conclusions regarding the influence of energy demands over the optimal sizing, from a technical-economical perspective, of cogeneration plants equipped with gas engines. The optimal sizing, the technical-economical efficiency estimation, of a cogeneration plant is obtained by applying the economical evaluation criteria and determining the optimal value of the nominal cogeneration coefficient.

Starting from the electrical and thermal energy demand from urban consumers the optimal value of the nominal cogeneration coefficient is determined, by using net present value (NPV) economic analyzes.

Depending on the electrical and thermal energy demand, for a compulsory nominal cogeneration coefficient, the operating mod of the cogeneration plant was established, determining the characteristic operation mod. Thus the primary energy quantities consumed and the electrical and thermal energy produced by each of the installed equipments are determined. The establishment of the operation mod determined the elements required for the economical estimation regarding the economical performance of the cogeneration plant. The optimal solution for the cogeneration plant sizing is determined in accordance with the values of the nominal cogeneration coefficient.

Ultimately we emphasized the influence of the main energy demand variation over the optimal sizing value of the cogeneration plant.

Keywords: cogeneration, energy demand variation, net present value

EXPERIMENTAL RESEARCH ON CO-COMBUSTION PROCESS OF PIT COAL WITH AGRICULTURAL BIOMASS

Ioana IONEL, Gavrila TRIF TORDAI, Adrian TENCHEA, Dumitru CEBRUCEAN, Alexandru SAVU

The research presented in this paper is part of several national research grants and mainly supported by a European network consortium and focuses on a facility, the experimental results, interpretation and future plans concerning the cocombustion of biomass with coal in a fluidized bed combustion pilot rig.

Keywords: Agricultural biomass, co-firing, pit-coal, fluidized bed.

CARBON DIOXIDE SEPARATION FROM CO-COMBUSTION PROCESS OF FOSSIL FUELS WITH BIOMASS

Dumitru CEBRUCEAN, Ioana IONEL, Alexandru SAVU, Corneliu UNGUREANU, Luisa-Izabel DUNGAN

Increase amounts of carbon dioxide emissions in the earth's atmosphere enhance the greenhouse effect and thus contribute to global warming. Since the start of the world industrialization, the atmospheric CO_2 concentration has considerably increased. The use and combustion of fossil fuels by humans is the major source of the emitted CO_2. Currently, fossil fuels supply over 80% of all energy demands and will likely remain so, into the 21st century.

Capture of CO_2 from fossil fuel fired power plants is drawing increasing interest as a potential method for the control of greenhouse gases.

The paper aims to analyze the process of capturing CO_2 from the flue gas by means of a chemical absorption process. Aqueous monoethanolamine solution (40% wt.) was selected for the removal of CO_2. Moreover, in this paper, a flue gas desulphurization method is well studied and presented. All experiments have been performed on an experimental lab facility. Experimental test results have shown that the emissions of CO_2, SO_2 and NOx have been significantly reduced during the removal processes and have proved the viability of these systems. The combustion process of biomass with coal in fluidised bed has been not affected by the biomass supply.

Keywords: CO_2 capture, MEA, biomass, co-combustion, fluidised bed.

INTEGRATION OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT INTO THE POWER PLANTS WASTE MANAGEMENTS STRATEGIES IN ROMANIA

Andreia PETCU, HORIA – IONUT PETCU

This paper presents a wide ranging series of propositions based on some broad ideas and logic. In Romania the largest quantities of waste produced in the last years by economical activities were made by energy power plants, deposited in open storage fields. Transition elements such as heavy metals play a central role in numerous chemical and biological processes in soil, underground water and plants.

As a result, the transition of the elements in the environment has been extensively studied, but major questions remain unsolved. At the same time different procedures for quantifying the costs and risk assessments are already applied.

The authors believes there is a need to treat the topic of sustainability both seriously and pragmatically, to embrace a much greater ambition for ecology in architecture of the olds and news waste landfills. Only knowledge of waste composition is not sufficient anymore. We will analyze the waste management strategies in Romania in balance with power plants company's strategies.

Keywords: ash and sludge deposit, risk, power plant, sustainable development.

MUNICIPAL WASTES AS A POSSIBLE ENERGY SOURCE FOR A CITY

Roxana PATRASCU, Cora GHEORGHE, Adriana PRIBEANU

The principal ground for the application of the wastes treatment or elimination methodologies is not the reason that the wastes are a raw material source or an energy source, but the presence of theses methods have a high environmental impact. In the European Union the incineration of the municipal wastes, with or without the recovering of the flue gases resulted, represents one of the most important methodologies for the treatment and elimination of the municipal wastes. At the same time, using these proceeds we can realize an energetic revaluation of the wastes.

In this paper we have inventoried the energetic potential of the municipal wastes collected from a municipal community and we have determined the low calorific power of the collected wastes. Using these values, we have calculated the quantities of the fuel (conventional fuel) which would be saved applying the wastes incineration technology for a certain period.

The next conclusions resulted from the analysis that we have realized. It refers at the reason that the municipal wastes incineration has a triple effect on the environment: it conducts to the physical elimination of the wastes; _ it reduces the environmental effects of the classic fuels utilization by conserving the existent raw materials, saving the fuel and obtaining the heat from the wastes incineration process; it assures a possible heat recovering from the flue gases resulted, characterized by a high thermal potential, which would evacuate to the environment an additional heat (simultaneous with the chemical pollution) affecting the ecological equilibrium.

Keywords: municipal wastes, environment, recovering, fuel saving, incineration.

THE EFFECT OF SUPERFICIAL GAS VELOCITY ON BUBBLE SIZE DISTRIBUTION IN DIFFUSED AERATION SYSTEMS

Irina PINCOVSCHI, Gabriela OPRINA, Florentina BUNEA

This paper focuses on bubble size distribution (BSD) in a rectangular column of 0.3□0.3 m cross sectional area and 1.1 m height, equipped with a ceramic porous diffuser of 50 mm diameter. Different values of average bubble size and bubble rise velocities are reported in literature due to the differences in the distributor design, column diameter and range of gas velocities. BSD is an important parameter for determining the volumetric mass transfer coefficient. A high speed digital video camera is used for direct flow visualizations and, combined with image processing, for BSD. Experimental results show that the structure of air-water dispersed system changes with increasing superficial gas velocity, from a homogeneous regime - characterized by small spherical bubbles and low bubble density, to a heterogeneous regime, where bubble deformation and density increase

Keywords: bubble size distribution, dispersed system, superficial gas velocity, flow regimes, image processing.

WASTEWATERS SEWAGE SLUDGE DISPOSAL BY PYROLYSIS AND OXYCOMBUSTION TREATMENTS

Marco ISCHIA, Chiara PERAZZOLLI, Roberto DAL MASCHIO, Lorenzo TOGNANA, Marco RAGAZZI

The feasibility to dispose wastewater sewage sludge through a two steps pyrolysis-vitrification process was studied. In the first step, the pyrolysis of the sludge takes place, with recovery of its energy content. In the second one, the solid residue of pyrolysis undergoes a vitrification process in an oxy-fuel fired furnace.

The kiln offgas allow the heating of the pyrolysis reactor. The research was firstly carried out by studying the pyrolysis of a sludge sample obtained from a municipal wastewater treatment plant. The pyrolysis was studied and monitored by thermogravimetric-mass spectrometric and thermogravimetric-gas chromatographic-mass spectrometric analyses. The sewage sludge mass loss, during the pyrolysis treatment, is 51.8% up to 600°C. Water, carbon mono- and di-oxide, several hydrocarbons (up to C5, both saturated and unsaturated) were the major detected species.

The stabilization of the pyrolysis process residue was obtained by vitrification in a pilot plant scale oxy-fuel fired furnace. The resulting material presents features of a totally inert vitreous matrix, showing excellent resistance against leaching of heavy metals ions, and it is suitable for commercialization in the

ceramics field. The energy balance confirms the sustainability of the proposed disposal process.

Keywords: pyrolysis, oxy-combustion, sewage sludge, thermogravimetric-mass spectrometric analysis**.**

WASTE PRE-TREATMENT BEFORE FINAL DISPOSAL: THE ROMANIAN PERSPECTIVE

Elena Cristina RADA, Marco RAGAZZI, Tiberiu APOSTOL, Valeriu PANAITESCU, Marina VENTURI

Since the beginning of 2007, Romania belongs to the European Union. The management of municipal solid waste (MSW) in the next years must comply with the European Union Directives. Aim of the present work is to present advantage and disadvantage of the waste disposal in Romania using different methods for treating the waste in order to decrease the putrescibility of the lanfilled material. The processes taken into account for treating the waste before landfilling are the aerobic (bio-stabilisation and bio-drying) and the anaerobic ones.

The paper will present some consideration and results regarding mass and volume balance, environmental and energy balances that will be compared with the ones from a landfill that receives MSW without pre-treatment.

Keywords: municipal solid waste, bio-drying, bio-stabilization, anaerobic digestion, life cycle analysis, energy.

REFUSE DERIVED FUEL AND THE INDUSTRIAL SECTOR: THE ROMANIAN PERSPECTIVE

Marco RAGAZZI, Elena Cristina RADA, Tiberiu APOSTOL, Alessio FRANZINELLI, Stefano ODORIZZI

Since January 1st 2007 Romania belongs to the European Union. That means that some scenarios in waste management could change. Presently in Romania the generated waste is mainly landfilled. Energy recovery from municipal solid waste (MSW) and special waste is an option slightly developed. The aim of the present work is to present an option that could be developed in Romania in the frame of the European Union Directives.

Keywords: refuse derived fuel, sewage sludge, biomass, energy, environmental impact.

UNIVERSITY AND INDUSTRY COOPERATION FOR ZOOTECHNICAL WASTE MANAGEMENT OPTIMISATION

Matteo ZANDONAI, Marco RAGAZZI, Elena Cristina RADA, Tiberiu APOSTOL

The aim of this work is to present a method for exploiting the zootechnical waste from cattle breeding in order to obtain energy and fertilizer. The process taken into account is the biological-anaerobic treatment in digester. ALPI BIOGAS, Competence Center for biogas in Southtyrol, is based on a network of public and private companies that can significantly develop the energy generation from biomass at small scale.

Keywords: waste management, zootechnical waste, bioenergy.

WORKING PARAMETERS EVALUATION OF THE STAND OF HYDRODYNAMIC PERFORMANCES OF VALVES

Carmen Anca SAFTA, Gheorghe BARAN, Mircea Dimitrie CAZACU

The paper presents the working parameters of the hydrodynamic performances stand of industrial process control valves. The stand could test industrial butterfly valves or gate valve with the dimensional size of 600 to 300 mm. Flow coefficient, K_v and velocity head loss coefficient of the valve, _, could be measured in the stand in accordance with international standard CEI/IEC 60534-2-1:1998. The stand of testing has a constant level tank which assures the permanent flow to a practical rate of 2.1 m3/s and the discharge by a head of 6.95 m. Hydraulic and hydraulic machinery Department of University Politehnica of Bucharest wants to respond to the European norm 97/23/EC regarding the pressure equipment.

Keywords: flow coefficient, velocity head loss coefficient, check valve, test procedure, Reynolds number, incompressible fluid.

SOLID WASTE TO ENERGY SOLUTIONS FOR SMALL AND MEDIUM SCALE POWER GENERATION

Cosmin MARCULESCU, Adrian BADEA, Tiberiu APOSTOL

The paper presents the results of the research on combustion, pyrocombustion and pyro-gasification treatment applied to non-dangerous solid waste with energy recovery. The decentralised power generation represents one of

the main targets for the European Union energy sector strategy. The alternative thermal treatment technologies as pyrolysis and gasification applied to "surface fuel", solid waste and biomass, represent the cutting edge processes for energy recovery. Both present undeniable advantages concerning the CO2 / treated waste rate and the dioxins formation being the alternative for a safer waste thermal treatment. The experiments for the solid waste thermal-chemical treatment were performed both at laboratory and pilot scale. The laboratory scale discontinuous experiments were performed on a tubular reactor using small quantities (5 – 10 grams). The obtained data was validated using representative samples on vibrating fluidized bed reactor that enables the continuous thermal treatment of 10 – 50 kg/h of solid product under an oxidant or reductive atmosphere.

Keywords: solid waste, biomass, combustion, pyrolysis, gasification, energy recovery.

THE HRA$_{IRC}$ SOFTWARE FOR ASSESSING THE HUMAN HEALTH RISK FROM WASTE-TO-ENERGY PLANTS

Diana COCÂRTA, Marco RAGAZZI, Adrian BADEA, Tiberiu APOSTOL

The waste incineration processes release substances which can accumulate in various environmental compartments: soils, vegetation, indoor dusts, animals and humans. The studies on the impact on public health from macro and micro pollutants released from significant punctual sources have shown a remarkable development during the last years.

The main aim of the current work was to develop a unique instrument for assessing human health risk that can induce toxically and persistent pollutants from waste incineration plants.

Like first approach, the methodology proposed in 1998 by US EPA (Methodology for assessing health risks associated with multiple pathways of exposure to combustor emissions, US EPA, 1998) together with an application of this methodology, for a waste incineration plant were considered. The EPA document is providing indications for assessments of human health risks that may result from multimedia and multiple pathways of exposure. The inception of multiple pathway assessment occurred in the late 1980's and was first applied to rule-making in the evaluation of multiple pathways of exposure to air pollutants emitted from municipal waste incinerators in 1987.

Moreover, it was developed a software which uses MATLAB as programming language to translate mathematical model (equations) in an instrument. The instrument is able to work in a real time with hundreds of formula and to support different variations as a consequence of the study particularities.

The advantages of having a package which permits to assess in a short period of time the human health risk from waste incineration plants have as consequence some other returns as: I. Decisional criteria on technological investments could be done in real time; II. The impacted area could be classified from agricultural use view; this influence the diet in a practical and sensible way, and is simple to be assessed through the developed software, just modifying some parameters in the input file; III. If the dispersion model used is the appropriate one, it is impossible that the individual risk assessed to not to take into account the climatological conditions that are characterizing the interested area; IV. The application of the present software could be extended to other punctual sources as thermal power plants, but also to linear (highways) or diffuse (landfill) sources.

Keywords: waste incineration, health risk assessment, software.

TECHNICAL AND ECONOMICAL CONCEPTS IN USING THE WASTEWATER TRANSPORT PIPES AS A PRETREATMENT METHOD

Catalina Raluca MOCANU, Dan ROBESCU

Numerous examples show that the dispersion and mass transfer of gas into a liquid mass are two important coefficients. This study considers a circular pipe through witch a homogenous fluid (clean water) flows and we will study the oxygen mass transfer from gas into liquid along the transport pipe. This method has an important impact over reduction the design costs of wastewater treatment plants.

Keywords: wastewater treatment, oxygen dispersion, modelling, simulation.

TRANSPORT OF REACTIVE POLLUTANTS IN GROUNDWATER. THEORETICAL AND NUMERICAL APPROACHES

Anca Marina MARINOV, Mihaela Amalia DIMINESCU

We study the transport of solutes in porous media considering the influence of chemical reactions. The transport equation for advection dispersion can be extended to include the effects of retardation of solute transportation through sorption, chemical reaction, biological transformations, or radioactive decay and including source sink term.

The advance of the contaminant front is retarded as a result of the transfer by adsorption of the contaminant mass from the pore water to the solid part of the porous medium. We will compare the numerical solution of the one dimensional

advection –dispersion – adsorption equation with some analytical results, for the constant aquifer velocity case. We propose an implicit numerical approximation for the transport equation of reactive pollutants in an aquifer considering the variable water velocity. We have done a numerical analyze of the model sensitivity with respect to retardation factor, decay coefficient and production.

Keywords: groundwater, advection, dispersion, pollution, retardation factor.

THE INFLUENCE OF VELOCITY VARIABILITY ON POLLUTANT DISPERSION IN GROUNDWATER

Anca Marina MARINOV, Mihaela Amalia DIMINESCU

We will consider the dispersion of a conservative pollutant into an unconfined aquifer. The contaminant source is a polluted lake which is a boundary for the groundwater.

Considering the continuity equation and the Darcy's law for an unconfined aquifer, the velocity and the water table level will be computed, related with the boundary conditions. The water table level h (x) is obtained from the steady-state equation of one-dimensional flow through a saturated, homogenous, isotropic aquifer. The unconfined aquifer is limited by two lakes whose levels and qualities determine the flow in the aquifer and the boundary conditions for the pollutant dispersion. The phreatic velocity is variable in x -direction. The variable aquifer's velocity will determine a variable dispersion coefficient along the aquifer. We propose a numerical solution of the one-dimensional dispersion equation, with variable coefficients and we analyze the difference between that one and the solution obtained for the dispersion equation with constant coefficients.

Keywords: groundwater, pollution, advection, dispersion, unconfined aquifer.

COMPARASION BETWEEN CHEMICAL AND ELECTROCHEMICAL TECHNIQUES FOR THE REMEDIATION OF PAH CONTAMINATED SEDIMENTS

Irina Aura OPREA, Elisa FERRARESE, Adrian BADEA, Giuliano ZIGLIO, Gianni ANDREOTTOLA, Marco RAGAZZI, Tiberiu APOSTOL

The aim of this experimental investigation was to assess the effectiveness and the feasibility of two different remediation techniques, chemical oxidation and electrochemical oxidation, for the remediation of fluvial sediments contaminated by polycyclic aromatic hydrocarbons (PAHs).

Chemical oxidation is a remediation technique that uses reactants to chemically degrade the organic pollutants, while in electrochemical oxidation an electrical field is created in the polluted medium by applying a low-voltage direct current to electrodes placed in the ground to induce electrochemical oxidation reactions. In the first phase of the research, the effectiveness of chemical oxidation was investigated. For this purpose several bench scale laboratory tests were performed, with the following reactants: hydrogen peroxide, modified Fenton's reagent, ozone, activated sodium persulfate, potassium permanganate, as well as some combination these oxidants. In the second phase, the applicability of electrochemical oxidation was studied. Some tests were performed in order to assess the effects of different voltages and exposure times. The voltages applied during this experimentation ranged from 1 V/cm to 2 V/cm.

Chemical oxidation proved to be an effective technology for PAH remediation, even tough different reactants resulted in different removal efficiencies. The best remediation performances were achieved with the use of modified Fenton's reagent, hydrogen peroxide and potassium permanganate, with high oxidant doses (about 100 mmols per 30 g sediment samples) which resulted in about 95% removal of total PAHs. The research about electrochemical oxidation showed that a 90% PAH removal could be easily achieved with a four week treatment under a constant voltage of 1 V/cm. Based on the results of this study, both chemical oxidation and electrochemical oxidation proved to be effective in the remediation of the sediments of concern. Because of the sediments heterogeneity and low permeability, chemical oxidation is thought to be applicable only in an ex situ remediation action, while the electrochemical treatment seems amenably applicable both in situ and ex situ.

Keywords: polycyclic aromatic hydrocarbons, chemical oxidation, electrochemical-oxidation, sediments, contamination.

THE PRINCIPAL RISKS CAUSED BY THE FIRE

Oleg SUSAN, Valeriu PANAITESCU

The fire which extends inside a building, and especially in ventilated or open spaces, have two distinguished phases: the fire in the first phase is checked by the fuel, and in the second phase by the disponible quantity of oxygen. In this second phase the occupants are facing major risks. In the second phase the fuel is not completed, because not all the pyrolysis products burn in the fire origin place, but spread with hot gases and smoke, existing the risk to set on fire the neighboring locations.

In the event of the incomplete burning also grows up the chemical risk too.

The theoretical burning gases quantity from the specific chemical reactions of a certain burning process can be determined through stochiometric calculations. But in many cases the burning is incomplete, because the substances which interfered in chemical reactions couldn't be recognized with accuracy. The

inhalation of the burning gases constitutes the principle cause in fires: the decease. The flashover phenomenon occurs when the temperature of hot gases touches values of 600$_0$ Celsius, but in other cases exist a thermal unsteady situation when the flashover can occur before the value of 300$_0$ C. The passage to the flashover is short in comparison with other phases of the fire, sometimes being just like a snapshot, as kindling. The flashover is also a process of short standing. Once the flashover occurs, the risk for people sensibly increases because the burning phase becomes generalized, creating temperatures up to 1100 $_0$ C. In this time, the resistance structures and the construction elements are very affected by the fire, they can crack and fall. As the most serious risk of the firefighting teams, we must recall the back draft phenomenon. In the event of not sufficient air quantity the burning intensity diminishes resulting two possibilities: either the fire enters in a regress phase, either a contribution of supplementary air (through the breakage of a window, the opening of doors) below the neutral plan of building, which challenged the appearance of back draft phenomenon followed by the flashover.

Keywords: fire, smoke, heat, ventilation.

POTASSIUM PERMANGANATE OXIDATION TREATMENT FOR THE POLYCYCLIC AROMATIC HYDROCARBONS CONTAMINATED SOILS

Lionel CHOPLIN, Gheorghe LAZAROIU, Catalina Raluca MOCANU

The experiment had two purposed: to determine the time required by the potassium permanganate solution to remove the PAHs from the soil and secondly, to establish the period of time in which the potassium permanganate outlet solution has the same concentration as the inlet solution.

Keywords: polycyclic aromatic hydrocarbons, PAH, potassium permanganate, column experiment, advanced oxidation

THE DETERMINATION OF THE PRODUCTION ENERGY COSTS FOR DIFFERENT COGENERATION SYSTEMS APPLYING THE ECO-TAXES – CASE ANALYSIS

Roxana PATRASCU, Cora GHEORGHE

The economic quantification of the ecological effects of the different cogeneration systems must reflect the production costs, the power and the heat prices. Concerning this domain, the Europeans studies emphasize the principal characteristic of the environmental taxes. Different from the other taxes, these improve the energetic efficiency and the eco-efficiency. This characteristic results

from the fact that the environmental taxes increase the interest for the use of the clean energetic renewable resources and, both, for the clean production technologies (technologies with high energetic efficiency and reduced pollution). In this case analysis, we have presented the application of the internalization methodology for the environmental externalizations in the costs of the heat and power production. This methodology was applied in the case of one industrial platform from a CHP. It can be used only if the law frame exists and stipulates the eco-taxes values. This economic "justification" of the ecological effects can be a part of the pre-feasibility study, and, then, of the feasibility study for the optimum solution's implementation of the energy supply. In the pre-feasibility study, as alternative solutions for the energy supply of the proposed industrial platform it can be considered: Air Turbine CHP (AT CHP), Gas Turbine CHP (GT CHP), Thermal

Motors CHP (TM CHP), Steam Power Plant (SPP). For all these energy production alternatives, we will analyze the influence of the eco-taxes on the energy production costs.

For this case study very important are: the establishment of the assumptions for the economic quantification analysis of the ecological effects and the establishment of the existent connections between the ecological aspects (the emissions value, the effect scores value) and the proper economic values (the energy tax, the carbon tax, the mixed tax, other taxes for different pollutants – if these pollutant exist). Following this case analysis, we have obtained that, for all energy production alternatives, the introduction of the eco-taxes has a big influence on the production costs for the both forms of the energy production. Under these circumstances, the ecological analysis of the solutions, which were proposed in the pre-feasibility and in the feasibility studies, can have an important influence on the proposed solutions ranking and on the tacked decision.

Keywords: eco-taxes, ecological effects, energy production, energy supply solutions

ADJUSTMENT OF BANKI HYDRAULIC TURBINE IN ORDER TO OBTAIN ELECTRICAL ENERGY FROM WIND POTENTIAL

Ioana Corina MOGA, Diana ROBESCU, Dan ROBESCU, Mircea BARGLAZAN

The energy demand in the whole world and in our country is in a continuous growth as an effect of the industrial and economical development. The main problem for society, experts and decision factors is the energetic resources. The necessity of a sustainable development imposes the development of the renewable energy sources especially for keeping those existing at a convenient level and at the same time for environment conservation.

In Romania the areas with o good wind intensity have a small size and these areas are placed in the mountains and near the Black Sea. In the other geographic areas the wind has low intensity fact that imposed to be made researches regarding wind turbines that can be used for speeds lower than 8 m/s.

This paper proposes a model of a wind turbine used in areas with low wind intensity. Banki hydraulic turbine has horizontal spindle, but this type of turbine can be adjusted for obtaining electrical energy from the wind. The paper will proposes a turbine model with vertical spindle.

Keywords: wind potential, Banki turbine, vertical spindle

ENVIRONMENTAL DATABASES FOR IRON GATES HYDROPOWER STATIONS

Daniela VASILIU, Stefania SBARCEA, Dragos ION GUTA, Marius BONTOS

The paper presents the structure and the performance of a new database needed for monitoring the environmental impact of the IRON GATES hydropower plants. The first part of the paper contains a short assessment of the environmental impact of the hydropower plants. The second part presents the database structure developed by a highly automatic data processing system, according to the European laws regarding the environmental protection. The database can be accessed by the power plants employees, but it is also world wide available by INTERNET. The informatics system is based on a L.A.M.P. structure (Linux, Apache, MySQL, PHP) including the following components: Linux operating system; Apache web server; RDBMS (Relational Database Management System) MySQL; Middleware (programming language) PHP. This structure allows the access to the information from a local dedicated server, or remotely, though the Internet, from a common web browser. The system will be managed and updated by the Iron Gates National Hydropower System, following the different requirements.

Keywords: environmental monitoring, hydropower stations, database, web.

MODELING OF ATTACHED GROWTH BIOLOGICAL WASTEWATER TREATMENT PROCESSES

Diana ROBESCU, DAN ROBESCU, Raluca MOCANU, Corina MOGA

The paper presents a theoretical model for kinetics of mobile bed biological wastewater treatment processes. Global mass balance equations are used for predicting substrate removal and microorganism growth in biological reactor. An original expression for active mass of microorganism in biofilm was introduced. A

simulation study was conducted for predicting substrate removal and microorganism growth in the system, using a Simulink model.

Keywords: wastewater treatment, attached growth biological treatment, modeling, simulation

OXYGEN CONSUMPTION IN BENTHIC SEDIMENTS: EXPERIMENTAL ANALYSIS OF THE TEMPERATURE INFLUENCE ON SEDIMENT OXYGEN DEMAND

Aurelia CALIN, Maurizio RIGHETTI, Gabriela DUMITRAN, Dan ROBESCU, Cristian TEODORU

Dead organic material accumulated on the bed of a lake, reservoir or wetland often provides the substrate for substantial microbial activity as well as chemical processes that withdraw dissolved oxygen (DO) from the water column. This paper proposes to study the process of oxygen consumption in benthic sediments from Serraia Lake taking into account the temperature influence.

Keywords: oxygen consumption, eutrophication, nutrient fluxes.

ECOLOGICAL FOOTPRINT AS A METHOD FOR SOCIOECOLOGICAL SYSTEMS APPROACH

Adrian CIOCANEA

This paper tries to elucidate the methods and work instruments used to simulation socio-ecological systems (CSE). Working of CSE may be described with specifically methods, using multi sector approach in which to be identifying common state variables of the system. Problems of modelling big systems are connected to hierarchical model structure, unless neglect the main variables, identify an integrated work method who will allow problem formalisation and use of quantifying tools in order to obtain data to estimate simulation results. This paper intent to develop a critic analyse for the three levels: model-method-instrument, regarding new approach of socio-ecological systems.

Keywords: ecological footprint, socio-ecological systems, economy, energy.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

AN ECOLOGICAL DECISION TOOL FOR NEW SMALL HYDROELECTRIC PLANTS ON ALPINE RIVERS AND STREAMS IN TRENTINO, ITALY

Paolo NEGRI, Maurizio SILIGARDI, Catia MONAUNI, Sabrina POZZI, Raffaella CANEPEL

In the over the past few years as well as foreseen in the future, there is a constant increase of electricity demand. This is leading to new constructions of hydroelectric plants especially of small dimensions (20-3000 kW) built on low order (and therefore more fragile) Alpine streams.

The aim of this paper is to describe the ecological evaluation process applied in Trentino in order to grant new plan construction permission. This methodology uses the results of Fluvial Functioning Index the Italian fluvial functionality index applied to the stretch of the river on which a small hydroelectric plant is planned.

The Fluvial Functional Index (FFI) is a method that allows the collection of information about the main ecological characteristics of watercourses, and is able to find functional aspects and interrelations between eco-topes. Through the description of morphological, structural and biotic parameters of the fluvial ecosystem, it is possible to determine the associated functionality of the river. The construction request is rejected if: 1. the stretch interested by the construction of the new plant has a mean score in high functionality level, or 2. at least 70% of the stretch is in high functionality level, or 3. at least 500 meters of the stretch on which the new plant is due to be constructed reaches a high functionality level. In this way the Provincial Government of Trento (Italy) has been able to control the great number of requests of new small hydroelectric plants and to protect the Alpine watercourses with highest ecological value.

Keywords: river ecology, hydroelectric plants, water management.

AN EVALUATION OF DRAG REDUCTION EFFECT IN TURBULENT FLOWS OF FLUIDS WITH POLYMER ADDITIVES

Cornelia Marieta CHIUJDEA

This presentation will review the way in which polymer solutions may reduce drag. Many complex fluids solutions exhibit phase transitions or dynamic instabilities under shear flow. The introduction of dilute polymers in a turbulent

flow changes some mean characteristics of the flow .This phenomena is very complex and well known as Toms effect in pipe flow. It represents the effect of drag reduction in turbulent flows of fluids with polymer additives. In order to describe the viscoelastic behaviour of this solutions it is usually necessary to be taken into account the elastic as well as viscous responses of these fluids. It is assumed that the elasticity of the macromolecule of polymer is essential in explaining Toms effect .In this connection the effect of different rheological properties of fluids on the near wall transient flow will be studied on the basis of the developed sinusoidal theory. We have advanced a theory which provide us to elucidate some new aspects regarding the way in which polymer may reduce drag.

Keywords: drag reduction, polymer additives, Toms effect, wall turbulence.

INFLUENCE DE LA GEOMETRIE AMONT SUR LES CARACTERISTIQUES AU POMPAGE DES COMPRESSEURS CENTRIFUGES

Michel TOUSSAINT, Mohamed BOUDFAR

According to the Kyoto's protocol, one of the major challenges for the car manufacturers is to decrease the emissions CO_2 in order to struggle greenhouse effect. One solution consists in "downsizing" by reduction of engines displacement. The use of high supercharging engines makes possible to use smaller engines with high specific power output and which allows lower consumption in case of urban and extra-urban traffic. At least, turbochargers with high compression ratios are required with a wide functioning area which leads to use the compressor close to its surge limit. When the surge limit is crossed, gas flow becomes unsteady and high pressures fluctuation occurs, which leads to vibrations unacceptable for an automotive driver. The surge limit of a centrifugal compressor is highly dependent to the geometrical configuration of his associated system (network). During these instabilities a "surge cycle" is describe with frequency and amplitude depending of upstream and downstream configuration. Tests have been down on our turbocharger test bench. The resistivity of the downstream duct is controlled by a valve. The upstream compressor configuration corresponds to the geometry usually met on the intake circuit air of the automotive engine. Three volumes of plenum (air filter box) have been experimented. In this paper is presented the influence of the resistivity on downstream circuit and upstream configuration on the amplitude and frequency of the instationnary fluctuations at low rotational speed, in the surge area. The results of these test series highlight the mutual influence of the upstream an downstream configuration in term of frequency and amplitudes fluctuations of surge cycles. Indeed, as well as the valve is closed, the surge frequency decrease more especially when the volume of plenum increases. Moreover, the amplitude fluctuations of surge cycle are less important when the volume of plenum increases. Le pompage d'un compresseur turbomachine est un phénomène fortement

instationnaire et dangereux qui affecte le compresseur et son circuit associé lorsqu'il est contraint de fonctionner à très faible débit. L'utilisation de compresseurs centrifuges pour la suralimentation des moteurs d'automobiles, peut les amener vers ce régime susceptible de provoquer des instabilités de fonctionnement de l'ensemble moteur et turbocompresseur. La limite de pompage d'un compresseur varie fortement en fonction de la géométrie de son circuit associé. La courbe caractéristique durant ce fonctionnement instationnaire décrit un « cycle dont la fréquence et l'amplitude dépendent directement des géométries amont et aval du circuit associé. On présente dans ce papier l'influence de longueurs de conduites et de volumes de réservoirs disposés à l'amont ducompresseur. Ces longueurs et capacités représentent, par exemple, les conduites d'aspiration et le filtre à air présents dans une configuration moteurturbosuralimenté.

Keywords: centrifugal compressor, surge limit, surge cycle,turbocharger.

TWO-DIMENSIONAL SIMULATION OF THE UNSTEADY FLOW THROUGH THE ACHARD TURBINE: COMSOL MULTIPHYSICS VERSUS FLUENT RESULTS

Sanda-Carmen GEORGESCU, Andrei-Mugur GEORGESCU, Sandor Ianos BERNAD

Two-dimensional numerical modelling of the unsteady flow through the blades of the Achard turbine, a new vertical axis cross-flow water turbine concept, is performed both with COMSOL Multiphysics 3.3a and with Fluent 6.01 software, in order to compare qualitatively the results and the software capabilities. The k −□turbulence model has been selected and same geometry and boundary conditions were considered within computations. Global results with respect to the pressure coefficients on the airfoils agree well with experimental data. The 2D computational approaches cannot fully predict the dynamic stall phenomenon that is reported in the case of vertical axis cross-flow turbines. 3D simulations are necessary to obtain an accurate description of the flow around a varying blade cross-section along the z-axis, like the delta blade of the Achard turbine.

Keywords: Achard turbine, cross-flow water turbine, airfoil, delta blade.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

PUMPING STATIONS OPERATING PARAMETERS UPON A VARIABLE DEMAND, DETERMINED NUMERICALLY FOR THE WATER DISTRIBUTION NETWORK OF ORADEA

Andrei-Mugur GEORGESCU, Sanda-Carmen GEORGESCU, Tudor PETROVICI, Magda CULCEA

The paper presents a methodology for computing the pumping stations operating parameters upon a variable demand. The study-case is performed for the complex water distribution network of Oradea (Romania), which incorporates 5 interconnected pumping stations, three tanks and a source of water. Oradea's water distribution network is modelled within EPANET through a main emitter, and the variable water demand is implemented by adjusting the throttle control valves (TCV) placed on 7 main pipes, upstream of the emitter. A TCV simulates a partially closed valve by adjusting the minor head loss coefficient of the valve, using simple controls. The numerical model of the pumping stations is created in EPANET and the operating algorithm of each pumping station is implemented via control statements (rule-based controls). Such an operating algorithm is created for one variable speed driven pump, in each group of pumps coupled in parallel. A

hydraulic analysis over a 48 h period is performed with variable water demand derived from the data recorded at the pumping stations in August, 2006.

Keywords: pumping station, water demand, throttle control valve, EPANET.

TRANSIENT BEHAVIOR ANALYSIS. STUDY CASE: PUMPING STATION GÂLCEAG

Georgiana DUNCA, Diana Maria BUCUR, Eugen Constantin ISBASOIU, Constantin CALINOIU

In the spring of year 2006, both hydro units of Gâlceag pumping station were damaged, the diffuser vanes being broken or deformed. This kind of accidents takes place as a result of the impeller-diffuser interaction which occurs in unsteady operating regimes.

The transient flow in multistage centrifugal pumps resulted from the impeller-diffuser interaction was studied numerical and experimental by many research specialists.

These observations were made using analogical measurement devices (manometers) and diagrams obtained from the pressure transducers.

The impeller-diffuser interaction effect makes the flow through the pump to be a very complex phenomenon. One of its aspects refers to the pressure variations which occur in the pump inlet and outlet. Important variations of pressure values in upstream and downstream pipe were observed during in site measurements and in all pump operation stages. Those pressure variations were observed in all pump operation stages.

Keywords: impeller, diffuser, transient, interaction, pressure variations.

CONTRIBUTION IN LACUSTRINE ENVIRONMENT NUTRIENTS ANALYSIS

Raluca IANCU, Gabriela DUMITRAN

This paper considers the development of a lacustrine ecosystem mathematical model that allows the ecosystem's main nutrients analysis. It had been necessary lacustrine ecosystem's specific nutrient's by-products and nutrient-environment interplay knowledge in order to develop the mathematical model.

The aim of the modelling process is to show the nutrients and theirs byproducts concentration variations in the interplay with the biotope, the biocenosys and other characteristic factors for the environment.

The model represents Siutghiol lake in Romania. The study period lasted a few months, from March 1st until November 30th, 2000. During this period, for the lake in question, there had been recorded data about nutrients' and theirs byproducts' concentration variations, continually with daily frequency.

We tried to show the part that nutrients play in the lacustrine environment, especially their effect on the lake's biocenosys during the important time periods in one year; we also showed the main causes that can lead to eutrofisation of the lake.

We have tried to emphasize the variation of the nutrients during the spring, when algae and other simple life forms begin to appear in the lacustrine environment, and continuing with the summer when their numbers increase and other superior life forms appear and they influence the cycle of the simple ones, and ending with the autumn when most of the biocenosys dies by decay.

Keywords: phytoplankton, epilimnion, hypolimnion, phosphorus, nitrogen.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

WATER JET CONTROL TECHNIQUE FOR SWIRLING FLOWS IN FRANCIS TURBINES DIFFUSER

Sebastian MUNTEAN, Romeo SUSAN-RESIGA, Alin BOSIOC, Sandor BERNAD, Ioan ANTON

Operating Francis turbines at partial discharge is often hindered by the development of the helical vortex (so-called vortex rope) downstream the runner, in the draft tube cone. The unsteady pressure field induced by the precessing vortex rope may also lead to hydro-acoustic resonance. We introduce in this paper a novel, simple and robust, method to mitigate the vortex rope by using a water jet issued from the crown tip. The vortex rope jet control method is investigated using 2D unsteady numerical simulation, and the benefits of this novel technique are quantified.

Keywords: swirling flow, water jet control, Francis turbine.

DEVELOPMENT A NEW TEST RIG FOR ANALYSIS AND CONTROL OF SWIRLING FLOWS

Alexandru BAYA, Alin BOSIOC, Adrian STUPARU, Sebastian MUNTEAN, Romeo RESIGA, Teodor MILOS, Liviu Eugen ANTON

The paper presents the main steps in order to develop an experimental test rig for analysis and control the swirling flows in draft tube cone of the Francis turbine. The main goal of test rig and experimental methodology developed will be focuses on the vortex rope generated in Francis turbines' draft tube. This is a very important matter in Francis turbine operation, because at partial load a cavitational vortex rope is developed. Consequently, strong vibrations and output power pulsations are generated. So, the contribution of hydropower plants equipped with Francis turbines at stability of energetic system is limited. A new solution is developed in order to mitigate the vortex rope using a new technique: based on injecting an axial water jet in draft tube. In order to investigate these phenomena a special swirl generator was designed based on numerical analysis. In the paper are presented the main aspects of hydraulic and mechanical design. Some experimental results concerning test rig operation domain a qualitative results of rope vortex development and mitigation, are also presented.

Keywords: draft tube, swirling flow, experimental analysis, jet control.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

TYPIFICATION OF SHPPS DEVELOPMENT

Liana-Ioana VUTA, Diana BUCUR, Mihaela DIMINESCU, Valeriu NISTREANU

Nowadays the development of renewable energies has become a necessity. The increase in electricity demands combined with international agreements to reduce greenhouse gas emissions to limit fossil energy use and ensure security of supply by reducing the dependence on the importation of fossil fuels are strong arguments for the development of renewable energies. Hydropower is the foremost electricity-producing renewable energy technology in terms of installed capacity and energy yield, both in Europe and the world.

Developing a small hydropower (SHP) site is not a simple task since small hydropower is not simply a reduced version of large hydro plant. Thus it is essential to develop and produce equipments specific to small power plants so as to assure the fundamental exigencies of simplicity, high energy efficiency, maximum reliability and easy maintenance.

Currently, most efforts concerning civil engineering aim at standardizing design and technology, in order to reach an optimal development of SHP plants (SHPP) and integration with the local environment while minimizing costs. Besides the works of civil engineering, the industry of the small hydropower associates mechanical and electrical high technologies combined with highly developed monitoring and surveillance processes.

The paper describes the criterion of micro hydropower development typification, the classification of micro hydropower plants depending of available head, as well as the possibilities of capitalization and consumption of the produced energy.

Keywords: micro hydropower, micropotential, hydro scheme, small HPP, powerhouse, turbines.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

SUITABILITY OF ACHIEVING A HYDROPOWER DEVELOPMENT AT MACIN ON THE DANUBE RIVER

Gabriela DIMU, Cornelia CODREANU, Manuela NICOLESCU, Bogdan POPA

The paper presents a possibility to achieve a hydropower development on the location of Macin, on the Danube River. The conclusion is that the investment would be profitable if the price of energy valuation were much higher than the one currently obtained in similar types of developments. Only reasons far more important than energy generation could justify the construction of Macin hydropower development.

Keywords: hydropower development, hydro-technical complex, economic analysis, water use.

INCREASING THE ENERGY PERFORMANCE OF IRON GATES I HPP THROUGH REFURBISHMENT AND UPGRADING ACTIVITIES

Bedros NAIANU, Mihail IONESCU, Elena POPESCU, Traian LACATUSU

The refurbishment and upgrading of the Iron Gates I HPP equipment represents, due to the technological complexity and investment effort, the most important and successful project of its category in the Romanian hydro energy system.

Applying the new calculation methods led to a significant modification of the geometry of the rotor blades, with remarkable effects in increasing the efficiency of the hydropower unit and, as a result, in increasing the power of the group as well as the generated energy.

The short term effect of upgrading the auxiliary equipment was simplifying the regular operating and maintenance activity.

Keywords: equipment tear and wear, refurbishment, increase of technical parameters

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

CAD TECHNIQUES USED TO OBTAIN THE BLADE SURFACE INTERSECTIONS WITH HORIZONTAL CUTTING PLANES FOR FRANCIS TURBINE RUNNER

Teodor MILOS, Mircea BARGLAZAN

Using CAD techniques for Francis turbine runners design enables an optimization of the blade shape hereby that energetic transfer to be realized with better efficiency then the old classical methods. For manufacturing the runner is necessary to cut the blade with horizontal parallel planes. These sections allow building of the blade step by step.

The classical method for identification of these sections presumes founding the intersection points of these planes with the profiles placed on the stream surfaces. In this way intersecting a stream surface with a plane on obtain maximum two points, one for pressure side and another for suction side of the profile.

Therefore the number of points obtained by the intersection with a horizontal cutting plane depends of stream surfaces number. Hereby the extreme area of the blade will result with reduce number of points and leading edge area too. The interpolation of the curves passing through these points will be approximately (great error span).

To have in view these shortcomings of the classical method it was searching for a new possibility to found of these intersections considering that the profiles placed on the stream surfaces are defined by many points (100…200). The network of lines segment which join these points defines the blade surface. Intersecting these line segments with horizontal cutting planes will be obtained maximum possible of points, depending of degree definition of profile boundary, indifferent of the area where intersection is made.

Keywords: CAD techniques, surface intersections, Francis turbine runner.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

THEORETICAL INVESTIGATIONS OF TEMPERATURE VARIATION IN TORQUE CONVERTERS OPERATING WITH TWO-PHASE FLOW

Mircea BARGLAZAN, Eugen DOBÂNDA, Teodor MILOS, Catalin Daniel STROITA

Torque converters are usually provided with a cooling circuit which assures an optimum (a convenient) oil temperature. In this article are studied the influence of closing the cooling circuit on the operation of CHC-350 torque converter by partial degree of filling with oil, namely with two-phase flow. Theoretically are deduced the shape of the characteristics curves of the torque converter operating with different oil temperatures. The numerical simulation of the flow in the first stator cascade stage, of the torque converter's torus, by different operating regimes is accomplished.

Keywords: torque converter, two-phase flow, analytical model, numerical simulation.

EXPERIMENTAL RESULTS OF TEMPERATURE VARIATION IN TORQUE CONVERTERS OPERATING WITH TWO-PHASE FLOW

Mircea BARGLAZAN, Adriana MANEA, Cornel VELESCU, Catalin Daniel STROITA

Hydrodynamic transmissions are usually provided with a cooling circuit which assures an optimum (a convenient) oil temperature. In this paper are investigated the influence of closing the cooling circuit on the operation of CHC-350 torque converter by partial degree of filling with oil, namely with two-phase flow. The facility used as testing rig is presented. Also is calculated the energetic balance of the torque converter, from thermal point of view. Experimentally are determined the temperature rise in time by different degrees of filling of the torus and by various resistant torques.

Keywords: torque converter, two-phase flow, experimental results.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

BOUNDARY ELEMENT METHOD APPLIED TO AXIAL AERODYNAMIC PROFILES CASCADE

Ionel Doru BACIU, Mircea BARGLAZAN

The paper presents Boundary Element Method (BEM) with linear elements for the numerical simulation of incompressible and ideal flow around reversible S axial profile cascades. Applying BEM to the Laplace equation in the stream function, the values of function, its normal derivative on the analysis domain boundary and the circulation are obtained. Next, applying BEM to the Laplace equation in the stream function and in the velocity potential function, the hydrodynamic field, the velocity field and the pressure field inside of the domain are obtained. The method was applied to a family of "S" axial turbine cascades.

Keywords: Boundary Element Method **(**BEM), _ boundary, Laplace equation, linear elements, essential condition, natural condition.

CANDU SEVERE ACCIDENT ANALYSIS

Gheorghe NEGUT, Alexandru CATANA, Ilie PRISECARU, Daniel DUPLEAC

Romania is now a UE member since January first 2007. New challenges are for our country that includes, also, their nuclear power reactors. Romania operates since 1996 a CANDU nuclear power reactor and soon will start up a second unit. In EU are operated PWR reactors, so, ours have to meet UE standards. Safety analysis guidelines require to model severe accidents for these types of reactors. Starting from previous studies a CANDU degraded core thermal-hydraulic model was developed. The initiating event is a LOCA with simultaneous loss of moderator cooling and the loss of emergency core cooling system (ECCS). This type of accident is likely to modify the reactor geometry and will lead to a severe accident development. When the coolant temperatures inside a pressure tube reaches 1000 C, a contact between pressure tube and calandria tube occurs and the decay heat is transferred to the moderator. Due to the lack of cooling, the moderator eventually begins to boil and is expelled, through the calandria vessel relief ducts, into the containment. Therefore the calandria tubes (fuel channels) uncover, then disintegrate and fall down to the calandria vessel bottom. All the quantity of calandria moderator is vaporized and expelled, the debris will heat up and eventually boil. The heat accumulated in the molten debris will be transferred through the calandria vessel wall to the shield tank water, which surrounds the calandria vessel. The thermal hydraulics phenomena described above are modeled, analyzed and compared with the existing data.

Keywords: CANDU, reactor, severe accidents, thermal hydraulics, debris.

MODELLING OF A CORIUM PROGRESSION IN REACTOR VESSEL AND CONTAINMENT DURING SEVERE ACCIDENT AT NPP

Sejed ASLKHADEMI, Ali MOGADDAM, Ivan KAZACHKOV

Nuclear power safety problems are recognized as the most important in further development of the nuclear power industry in the world and present operation of the nuclear power plants (NPPs), which are still considered by many countries as the highest priority energy source. The paper is devoted to the problems of corium retention inside the containment during severe accidents at the NPPs and their modeling, which have a great importance for guaranteeing the safe operation of the stations.

In the nuclear reactors of the third generation, which be necessary at the change to the operable reactors of the second generation, the presence of a passive systems (they are capable for work even under the conditions of the complete energizing of station) is required for NPPs protection from the severe accidents, to localize emergency and to prevent leakage of the radioactive materials outside the containment. As far as the containment is the last safety barrier of NPP, the problem considered is of paramount importance for nuclear power safety.

For a successful construction and an operation of the passive safety systems it is necessary to carry out modeling and simulation of the different thermal hydraulic processes with the "hypothetical severe accidents" scenario, in order to be acquainted with the processes taking place and to build the correct and effective protective system on the basis of the obtained in such simulation knowledge.

Keywords: nuclear power, safety, passive, protection, modelling, simulation.

VOID EFFECT STUDIES CONCERNING ADVANCED CANDU FUEL PROJECTS

Andrei RIZOIU, Iosif PRODEA

A major drawback of the standard CANDU nuclear power reactor is the positive Coolant Void Reactivity (CVR). Several improved fuel designs known as Low Void Reactivity Fuel (LVRF) were proposed by AECL (Atomic Energy of

Canada Limited) in the frame of the Advanced CANDU Reactor (ACR) project (CANDU, CANFLEX and ACR are registered trademarks of AECL). The paper presents the results of nuclear data sensitivity calculations on void effect with different CANDU fuel projects, containing both Natural Uranium (NU) and Slightly Enriched Uranium (SEU) with different enrichments. Twelve void fractions between 0 and 99% were considered for each fuel cell. The transport code DRAGON was used in this respect. The next step was to estimate the "sensitivity" induced by using different nuclear data i.e. two versions of the WIMS library emerged from the WLUP project sponsored by IAEA. The void reactivities for the advanced fuel projects are smaller than those calculated for standard CANDU and they are negative, as expected. Using the two versions of the WIMS library (based both on ENDF/B-VI and ENDF/B-VII) lead to less significant differences.

Keywords: ACR, CANFLEX, Coolant Void Reactivity, DRAGON, WLUP.

PRESSURE DROP VARIATION AS A FUNCTION OF AXIAL AND RADIAL POWER DISTRIBUTION IN CANDU FUEL CHANNEL WITH STANDARD AND CANFLEX 43 BUNDLES

Alexandru CATANA, Nicolae DANILA, Ilie PRISECARU, Daniel DUPLEAC

CANDU 600 nuclear reactors are usually fuelled with STANDARD (STD), 37 rods fuel bundles. Natural uranium (NU) dioxide (UO_2), is used as fuel composition. A new fuel bundle geometry called CANFLEX (CFX) with 43 rods is proposed and some new fuel composition are considered. Flexibility is the key word for the attempt to use some different fuel geometries and compositions for CANDU 600 nuclear reactors as well as for innovative ACR-700/1000 nuclear reactors.

The fuel bundle considered in this paper is CFX-RU-0.90 that encodes the CANFLEX geometry, recycled dioxide uranium (RU) with 0.90% enrichment. The goal of this proposal is ambitious: a higher average discharge burn-up up to 14000MWd/tU and, for the same amount of generated electric power, reduction in nuclear fuel fabrication, reduction of spent nuclear fuel radioactive waste and reduction of refueling operational work by using fewer bundles.

An improved sub-channel approach for thermal-hydraulic analysis is used in this paper to compute some flow parameters, mainly the pressure drop along the CANDU 600 fuel channel when STD or CFX-RU-0.90 fuel bundles. Also an intermediate CFX-NU fuel bundle are used, for gradual comparison. For CFXRU_ 0.90 four fuel bundle shift refueling scheme is used instead of eight, that will determine different axial power distributions. In the same time radial power distribution is affected by the geometry and by the fuel composition of fuel bundle type used. Some other thermal-hydraulic flow parameters will be influenced, too.

One of the most important parameter is pressure drop (PD) along the fuel channel because of its importance in drag force evaluation. We start with an axial power distribution, which is characteristic for a refueling scheme of eight or four fuel bundles on a shift. Comparative results are presented between STD37 , CFX-NU CFX-RU-0.90 fuel bundles in a CANDU nuclear reactor operating conditions.

Neutron flux distribution analysis shows that four bundle shift scheme is suited for CANFLEX-RU-0.90 fuel bundles while eight are suited for STD37 andCFX-NU. Some other thermal-hydraulic parameters like critical heat flux, density distribution, void distribution, velocities, are computed and some briefly presented.

Keywords: CANDU, pressure drop, CANFLEX, recycled Uranium, sub-channel thermal-hydraulics, waste minimization.

REACTOR, TURBINE AND FEEDWATER REGENERATIVE SYSTEM - ASSEMBLY BEHAVIOR

Melania BIGU, Mircea TENESCU, Iulian Pavel NITA, Ilie PRISECARU, Daniel DUPLEAC

The paper presents the results of heat balance calculation of complete secondary circuit of NPP Cernavoda Unit 1. We made several calculation in order to calculate the abnormal regimes caused by loss of one of the of the regenerative reheater. Previous calculation made by General Electric took in consideration reduce of the reactor power from nominal power to 90% of nominal power. The loss of power due to abnormal operation was of about 12-14% of nominal power. In our calculation we considered that reactor power was kept at a constant level – nominal power- in order to reduce the loss of power due to operating in an abnormal regime. From our calculation resulted a loss of power of maximum 4% of nominal power, much less then the prior case in witch reactor power was reduce to 90%. We oncluded that operating at 100% of reactor power in abnormal condition of loss of one of regenerative reheaters is both more safety and more economical (about 50000 Euro/zi) and we recommend changing the operating procedures for this abnormal regime.

Keywords: heat transfer, thermal efficiency, secondary circuit.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

PSA SUPPORT SAFETY ANALYSIS USING RELAP5 FOR THE REACTIVITY INSERTION EVENT AT TRIGA 14 MW REACTOR

Mirea MLADIN, Daniela MLADIN, Ilie PRISECARU, Nicolae DANILA, Daniel DUPLEAC

The paper presents the deterministic support analysis in case of Reactivity Insertion Accident (RIA) considered as initiating event in the PSA project. It studies the reactivity worth necessary to damage the research reactor fuel. Previously in the PSA study the postulated initiating event of error in the fuel manipulation was considered as a result of dropping one or maximum two fuel bundles from the lifting device in case of core configuration rearrangements.

This type of event was actually produced in the nineties. The paper gives some elements of the previous PSA model with respect to this initiating event: the event tree and the results of the accident sequences. The focus of the paper is on the results of thermalhydraulic code RELAP5 Mod 3.2 which uses a point kinetics model for studying the transient in case of different reactivity worths and insertion times.

The results include evolutions of heat transfer mode, maximum temperature inside fuel elements and peak values of the power excursion. The conclusions highlight the possibility of infringement of the safety criteria for the TRIGA SSR 14 MW reactor during the analyzed transients and also discuss the necessity of including this event in the PSA model.

Keywords: reactivity insertion analysis.

CANDU-6 NPP LIFE EXTENSION ASPECTS

Dan VIDICAN, Marian BADEA, Virgil IONESCU, Ilie PRISECARU, Daniel DUPLEAC

The objectives of this paper is to give a highlight of the major aspects associated to plant life management and to provide as much details as it takes about the activities required to accomplish an hypothetical project of life extension for a nuclear installation, beyond its licensed design life.

The US-NRC License Renewal Application methodology is applied to a CANDU-600 type of NPP.

Keywords: degradation, life extension, critical components.

CANDU FUEL CYCLE ECONOMIC EFFICIENCY ASSESSMENTS USING THE IAEA-MESSAGE-V CODE

Iosif PRODEA, Cristina Alice MARGEANU, Ilie PRISECARU, Nicolae DANILA, Corina AIOANEI

The main goal of the paper is to evaluate different electricity generation costs in a CANDU Nuclear Power Plant (NPP) using different nuclear fuel cycles. The IAEA-MESSAGE code (Model for Energy Supply Strategy Alternatives and their General Environmental Impacts) will be used to accomplish these assessments. This complex tool was supplied by International Atomic Energy Agency (IAEA) in 2002 at "IAEA-Regional Training Course on Development and Evaluation of Alternative Energy Strategies in Support of Sustainable Development" held in Institute for Nuclear Research Pitesti. It is worthy to remind that the sustainable development require satisfying the needs of present generations without compromising the possibility of future generations to meet their own needs. Based on the latest public domain information in the next 10-15 years four CANDU-6 based NPP could be in operation in Romania. Two of them will have some enhancements not clearly specified, yet. Therefore we consider being necessary to investigate possibility to enhance the economic efficiency of existing in-service CANDU-6 power reactors.

The MESSAGE program can satisfy these requirements if appropriate input models will be built. As it is mentioned in the dedicated issues, a major inherent feature of CANDU is its fuel cycle flexibility. Keeping this in mind, some proposed CANDU fuel cycles will be analyzed in the paper: Natural Uranium (NU), Slightly Enriched Uranium (SEU), Recovered Uranium (RU) with and without reprocessing. Finally, based on optimization of the MESSAGE objective function an economic hierarchy of CANDU fuel cycles will be proposed. The authors used mainly public domain information on the different costs required by analysis.

Keywords: CANDU fuel cycle, sustainable development, IAEA-MESSAGE.

U. P. B. Sci. Bull., Series C, Vol. 69, No. 4, 2007 ISSN 1454-234x

ISOLATION OF I&C CABINETS AGAINST SHOCKS, VIBRATIONS AND SEISMIC MOVEMENTS

George CIOCAN, Madalina ZAMFIR, Ioana FLOREA, Marian ANDRONE,Viorel SERBAN, Ilie PRISECARU

This paper is presenting SERB-SITON solution to isolate the I & C cabinets against shocks, vibrations and seismic movements.

The seismic qualification is required because the I & C components installed inside the cabinets are generally sensitive to shocks, vibrations and seismic movements and many times, the manufacturer does not guarantee them for a level of shocks, vibrations and seismic movements higher and equal to the level in the location they are installed.

The document also presents the solution to isolate such I & C cabinets associated to the sulphur hydrogen compressors located in ROMAG-PROD Drobeta Turnu-Severin.

Keywords: shocks, vibrations, seismic movements, SERB-devices, isolation method.

IMPACT OF THE ALTERNATIVE FUEL WITH PLUTONIUM AND MINOR ACTINIDES ON A CANDU REACTOR

Elena Nineta BALAS (GHIZDEANU), Nicolae DANILA

The appropriate management of radioactive waste arising from the nuclear fuel cycle is considered to be a key issue in the development of sustainable nuclear energy systems. In this context, the partitioning and transmutation of actinides could play an important role through the achievement of very significant reductions in the actinide content and radiotoxicity of the high-level waste requiring geological disposal.

The research of the transmutation of waste has been focused on three parts: long-lived fission products, plutonium, and minor actinides. For Pu and Minor Actinides transmutation CANDU reactor seems to be a well suitable versatile machine.

In this paper it is presented the possibility to transmute Plutonium and Minor Actinides in a CANDU reactor. More specific, the paper presents the reactivity effects obtained by inserting a fuel containing Pu and Minor Actinides. Because, the first stage in the transmutation process is the isotopes inventory formed in the spent fuel, in the paper is made an analyse of the resulted isotopes and their concentration before and after the inserting the fuel element containing Pu and Minor element. All simulations are carried out by using WIMS – 5b code. The results are obtained in order to have a clear vision of the reactivity effects and the isotope concentration in a CANDU reactor running with alternative fuel. As a conclusion, the analyses are made for the purpose of establishing of the optimal transmutation solution from the point of view of nuclear safety and efficiency of the transmutation process in a CANDU reactor.

Keywords: radioactive waste, spent fuel, transmutation, CANDU reactor, Plutonium and Minor Actinides analysis.