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Scientific papers regarding simulation results and methodics of model formulation in hydrogeology, electrodynamics, hydrodynamics, ecology, optical waveguides, signal processing, and insurance models.

The volume may be of importance to specialists and students interested in computer simulation of various environmental phenomena.

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Abstracts

S. Sujecki *Beam propagation in non-linear tapered co-ordinate system*

The School of Electrical & Electronic Eng., The University of Nottingham, Nottingham, UK

ABSTRACT: A beam propagation technique is presented which allows the solution of the wave equation in the case of a dielectric taper without the necessity of staircasing. The method consists in application of the non-linear tapered co-ordinate system. As a result curved boundaries between core and cladding can be modelled exactly. The results obtained are compared with the ones computed using the standard Beam Propagation algorithm in the rectangular and tapered co-ordinate system. In all analysed cases the novel approach: Non-linear Tapered Beam Propagation Method allows calculating the field distribution and the field overlap at the end of the structure faster and using less computer memory. (pp. 5-11)

W.Solnik & Z.Zajda *Automation of oxygenation process in biological treatment plants*

Institute of Engineering Cybernetics, Technical University of Wrocław, Poland

ABSTRACT: Basic applications of programmable controllers in the sewage aeration control systems are considered. Configurations of binary control systems with one- and two-speed blowers as well as systems with PID programmable regulators are presented. Advantages and disadvantages of these solutions and experiences collected during utilization of implemented projects are discussed. (pp. 12-17)

M.Gregorauskas, A.Klimas & A.Bendoraitis *A model of oil water disposal into heterogeneous aquifer*

Vilnius Hydrogeology Ltd., Lithuania

ABSTRACT: In order to forecast injected oily brine spreading at P2 aquifer, regional spatial filtration and migration models have been constructed. Trivial calculations shows that after 0.365 million m³ of oily water is injected during 10 years, it will spread in the area with a diameter of only 250 m. Further spreading of oily water will be caused by the processes of advection of disposed brine, its dispersion, as well as sorption and biodestruction of hydrocarbons. Therefore the modelling shows that the brine spreading will be very slow - only

after several thousand years the "tongues" of injected oily water can reach the Klaip?da waterworks situated at a distance over 20 km. However, admixture of brine in P2 water will be in fact inconspicuous. Concentration of hydrocarbons even within the limits of oil fields will not exceed 0.3 mg/l. (pp. 18-27)

A. Spalvins & R. Janbickis Misfortunes of zone scheme applied for storing hydrogeological data

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: Misfortunes of the zone scheme unwisely applied by modelling programs for storing data of novel hydrogeological models (HM) are analysed. Methods for tuning zone converter modules are described, in order to help modellers to lessen side effects caused by this scheme. (pp. 28-31)

A. Spalvins, J. Slangens & R. Janbickis Boundary shells of hydrogeological models as interpolation devices

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: For complex hydrogeological models (HM) including areas of non-existent geological structures, it is difficult to specify boundary conditions on the HM shell. These conditions can be obtained automatically when the shell of HM is used, as a special interpolation device. (pp. 32-34)

J. Slangens & A. Spalvins Creating reliable program for preparing line data of hydrogeological models

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: Line data are the major part of information needed to create hydrogeological model (HM) by the team of the Environment Modelling Centre (EMC), the Riga Technical University. The CPR program prepares these data, as the input for interpolation. This paper describes the updated CRP version of improved reliability. (pp. 35-40)

I. Lace & A. Spalvins Incorporating geological sections in hydrogeological models

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: The geological section presents a carrier of verified hydrogeological information. To incorporate it into a hydrogeological model (HM), the special program has been developed by the Environment Modelling Centre (EMC) of the Riga Technical University. (pp. 41-46)

A. Spalvins Landscape elevation maps as reliable boundary condition for hydrogeological models

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: The team of the Environment Modelling Centre (EMC) of the Riga Technical University has developed an effective method incorporating the landscape elevation map, as the boundary condition of the three-dimensional (3D) hydrogeological model (HM). Due to this handy application, reliability of any HM improves considerably. (pp. 47-50)

A. Spalvins¹, J. Slangens¹, R. Janbickis¹, I. Lace¹, E. Gosk² & L. Loukiantchikova³ New simulation technologies applied for creating hydrogeological model of Noginsk District, Russia

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³ All-Russian Research Institute for Hydrogeology and Engineering Geology, Russia

ABSTRACT: Since 1993, the team of the Environment Modelling Centre (EMC) of the Riga Technical University is being active in the field of developing methodologies and special software for creating hydrogeological models (HM). In this paper, these tools applied together with commercial ones are described, on the example of complicated HM created for the Noginsk District, Russia. (pp. 51-56)

M.Ya.Antimirov & I.A.Dzenite Closed form solutions of some eddy current problems

Riga Technical University, Institute of Engineering Mathematics

ABSTRACT: Eddy current testing is widely used for the quality control of electrically conducting objects, such as metals, alloys and semiconductors. An important application of eddy current testing is the quality control of spot welding in transportation industry, including aircraft, ship and automobile. In monograph [Antimirov, 1997] the influence of uniform and non-uniform conducting mediums with different geometries on the current source in the form of a coil or a double conducting line is investigated. The expressions for impedance change characterizing the influence of conducting medium on the source of current are derived in terms of the integrals and series. In this note the integral for double line is evaluated in closed form in the case, when a source of current is located on the surface of conducting half-space, but the integral for a coil is transformed into simpler form. Furthermore, the simple asymptotic formulae for impedance of arbitrary situated double line and coil in the limit as frequency tends to infinity, are obtained.(pp. 58-68)

A.Kolyshkin & I. Volodko On the stability of velocity profiles with reverse flow in a pipe

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: Hydrodynamic stability of velocity profiles with reverse flow in a pipe with circular cross-section is studied in the present paper. It is shown that shear flow formed by a cylindrical fluid core moving with a constant velocity in one direction and a surrounding annulus moving with a constant velocity in the opposite direction is inviscidly unstable for all wavenumbers. A more realistic case with a parabolic velocity distribution between the cylindrical core and the surrounding annulus is shown to be unstable in the interval of small wavenumbers. The width of the interval depends on the thickness of both fluid layers. (pp. 69-73)

A. Matvejevs Insurance models of pension benefits

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: Actuarial method of the tariffs for pension benefits using conditions of transformation of the insurance contract, changes of the size of the insurance premiums and/or insurance benefits is considered. Three kinds of the annuity contracts are described: term insurance of n years, life annuity insurance contract, and life annuity insurance contract with guaranteed period of benefits. The financial obligations for the accumulation period, waiting

period and benefit period are separately examined. The surrender value in case of alteration of the contract under the initiative of the participant is considered. (pp. 74-78)

J. Bleiers¹ & J. Lavendels² Support of real time tasks in the signal processing environment of telecommunication system

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ABSTRACT: A multiprocessor signal processing environment for telecommunication system where multiple signal processing tasks are supported by every DSP is discussed. Presented software contains, at first, background part with arbitration of functions to be executed relatively in parallel. Second part is interrupt service routine that includes unvarying block of executing algorithms and links for parallel functions. Each of signal processing tasks must be evaluated for its correspondence to either the background or the interrupt routine part. (pp. 79-83)

M. Buikis & G. Burov Topological - associative analytical model of forecasting of dynamic processes

Institute of Information Technology, Riga Technical University, Latvia

ABSTRACT: The analytical associative algorithm of forecasting of dynamic processes is considered. The idea of the making recurrent digital filter (Burov, 2000). At a choice of its parameters the auto regressive model in a combination to the associative approach is used. The criterion of the coordination of transfer function of the filter with structure apriori of the given process is used. Before application the adequacy of the predicting filter apriori to the given experimental data is checked. Besides it is offered on their basis to estimate expected accuracy of the predicting filter. For this purpose the work of the filter on the apriori information is simulated. The recurrent iterative procedure of forecasting is applied and the step-by-step character of increase of an error of the forecast is estimated. On a concrete example the advantages of the offered approach are shown in comparison with ARV (Rastrigin and Vulfs, 1997). (pp. 84-93)

G. Burov & G. Vulfs *The analysis of accuracy of associative algorithm of identification on a discrepancy of the equations of model*

Institute of Information Technology, Riga Technical University, Latvia

ABSTRACT: The accuracy of analytical associative model of identification of dynamic object is investigated. The approximation of algorithm offered in (Rastrigin and Vulfs, 1997), results to non-forecasting to change of errors. It is formed under the apriori information of numerical character written down in the protocol of supervision. Therefore in such algorithm it is difficult to determine the reason of occurrence of significant ejection of errors and loss of its serviceability. It is offered to use analytical associative model, in which the apriori information of mathematical character is used. Such model can work in conditions of a minimum of the information. It supposes check of adequacy. This property is used for the analysis of discrepancies of systems of the conditional equations. Their numerical estimates of discrepancies are used for a filtration of the information of the observation protocol and adjustment of parameters of algorithm. (pp. 94-103)

A.Ozols *Delays of traffic flow in regulated junction*

Road Traffic Control Laboratory, Riga Technical University, Latvia

ABSTRACT: Because of the increasing automation there are more and more situations in the junctions of the city streets, when the traffic flow that comes to the junction do not drive away from it during the time of the current cycle. That, in its turn, leads to serious losses of national economy. With a presumption that traffic flow is regular, a graph-analytic method is offered to determine delays of traffic flow in the regulated junctions. Total delays and also total losses of national economy are determined for real traffic flow on one of the Riga's streets in one direction, with the worked out method as the bases of it. The results can be used to substantiate the necessity of improvements in organizing the traffic.(pp. 104-109)