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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.

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Address:

1 Meza Street, Riga, LV-1048, Latvia

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Abstracts

Kaczmarek T. and C. Kaczmarek A nonlinear lightguide as a transmission medium of ultrashort chirped hyperbolic secant shape and Gaussian pulses

Kielce University of Technology, Institute of Telecommunications and Photonics, Kielce, Poland

Warsaw University of Technology, Institute of Electronic Systems, Warszawa, Poland

ABSTRACT: The propagation of ultrashort chirped hyperbolic secant shape and Gaussian pulses in a nonlinear lossless fiber is considered. Nonlinear Schrödinger Equation is solved numerically for complex initial conditions using the Split-Step Fourier and the Beam Propagation Methods. It is demonstrated that a hyperbolic secant shape pulse is less sensitive to destructive influence of the initial chirp than a Gaussian pulse. (pp. 5-11)

Kaczmarek Z. Waveform reconstruction of impact force using a frequency domain technique and one-point strain measurement

Kielce University of Technology, Institute of Electrotechnics and Metrology, Kielce, Poland

ABSTRACT: In the paper a transformational impact force reconstruction method is presented, which features a one-point strain measurement in a mechanical transducer. To determine the spectral transmittance of a section of the mechanical transducer necessary in the reconstruction process, strain waves propagating in the transducer are used: the incident, and the first reflected one, created by the impact. Restrictions concerning the impact duration as well as the strain gauge localization on the mechanical transducer are given, which assure the non interference of the above mentioned waves in the strain gauges. The reconstruction results of impact force waveforms generated during impacts of steel spheres in the front face of a steel bar are presented. The consistency of the obtained reconstruction results with the Hertz Impact Theory with respect to the duration and amplitude of the impact force was evaluated. (pp. 12-18)

N.X. Duong & V.K. Khrutch Computational modelling of flow and pollution transportation in open channel with complicated geometry and bottom relief

Dnipropetrovsk National University, Dnipropetrovsk, Ukraine

ABSTRACT: A 2-D depth-average computational model based on the shallow water theory including aspects of non-uniform bottom relief has been developed. An explicit differential scheme formulated on the "one-sign" transport matrixes has been used for solving the boundary problem of non-conservative form. Corrections to the differential scheme are proposed to provide good agreement with available basic solutions of the equations system. In couple with the flow module, the diffusive-transport equation has also been solved respectively at each time step to predict the depth-average concentration or surface concentration of pollution spreading in a channel that contained islets. (pp. 19-25)

Kolishkin A. and I. Volodko On the linear stability of unsteady flow in a plane channel

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: Unsteady flows of incompressible fluid under abrupt change in pressure and flow rate are of great interest to engineers. Such flows often occur in applications. The transient flow of a viscous incompressible fluid during short time interval followed by a sudden change of total fluid flux is studied in the pre-sent paper. Exact analytical solutions for flow velocity in a plane channel are found by the method of Laplace transform. The analysis of the solution indicates that there are two typical time scales related to the transient fluid flow: short (convective) time scale and long (diffusive) time scale. Therefore the solution is presented in two useful forms suitable for engineering calculations for short values of the time (in terms of the complementary error functions) and for long values of the time (in terms of an infinite series). The calculated velocity profiles for short times are similar to those obtained by other authors experimentally and numerically. Linear stability of unsteady flow in a plane channel is investigated by quasi-steady approach. It is shown that the critical Reynolds numbers decrease considerably on a short (convective) time scale, therefore the additional energy dissipation due to formation of secondary flows takes place in transient flows. (pp. 26-31)

Antimirov M. and I. Dzenite Evaluation of new classes of definite integrals and its applications to eddy current testing

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: New classes of definite integrals are evaluated in closed form by means of divergent integrals, which converge in the sense of Abel (Antimirov et al. 1993). The integrands of these integrals are either combination of irrational and trigonometric functions or combination of irrational and Bessel functions. The applications of particular cases of these integrals for closed form solutions of some eddy current testing problems are considered. (pp. 32-39)

Antimirov M. and I. Dzenite Exact solution of the problem on the vector potential of a wire of finite length with current by integral transforms

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: Exact solution for the problem of spreading of electromagnetic waves from a wire of finite length is obtained in the exact formulation without using the dipole approximation. Current in the wire is varied according to the harmonic law. Solution for the vector potential is obtained in the form of integral of an elementary function. The result obtained is used to construct a solution for the problem of spreading of electromagnetic waves from a rectangular frame with current. The solution for the problem of spreading of electromagnetic waves from a linear harmonic oscillator is obtained by using the dipole approximation in the exact solution found in the present paper. (pp. 39-47)

Ligere J. On a dependence between the smoothness of the boundary velocity of the fluid and the full pressure force at the entrance of the region

Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: Analytical solution of two problems on inflow of the viscous fluid through the plane split of finite width or through the round hole into half-space is obtained in the Stokes approximation. The velocity of the fluid at the entrance of the region is given either as a constant (i.e. as a function with finite jump) or as a parabola (i.e. as the continuous function). It is shown that in the first case the full pressure force at the entrance of the region is equal to infinity and consequently such flow is physically unreal. In the second case the full pressure the entrance of the region has finite value. In the case of the plane split the solution is obtained in terms of elementary functions but in the case of round hole the solution is obtained in the form of integrals involving Bessel functions. (pp. 48-58)

Matvejevs An. and Al. Matvejevs Joint life and last survivor benefits for married couples

Riga Technical University, Riga, Latvia

ABSTRACT: Three kinds of the insurance policies for the net premium calculation for married couples are considered. The net premium equation principle is used in all premium calculations. The particular quality of the additional pension assurance is the individual form of its undertaking and the limitation of annual (monthly) pension payments. Due to this fact the biggest interest to the individual insurance show people after age 40-45 years, when the insurance premium rates are so high that most people can't buy such policies. So, the discussed form of the joint life insurance could be proposed to the participant of the pension plan when he or she is reached the pension age and wants to buy the life insurance policy for the accumulated capital of pension. (pp. 59-68)

Bleiers J.1) and J. Lavendels2) Control of background tasks in the hard real time signal processing environment of telecommunication system.

1) Riga Technical University, Environment Modelling Centre, Latvia

2) Riga Technical University, Software Department, Latvia

ABSTRACT: A multiprocessor signal processing environment for telecommunication system where multiple signal processing back ground tasks are supported by every DSP is discussed. Two types of back ground control procedure are observed. Interrupting service routine includes unvarying block of executing algo-rithms and links for parallel functions. Each of control methods can be used in signal processing software. (pp. 69-73)

Bleiers J.1), A. Kalejs1), G. Linis2) and N. Veselis2) Closed form solutions of some eddy current problems

1) Riga Technical University, Riga, Latvia

2) Institute of Mathematics and Computer Science of the University of Latvia, Riga, Latvia

ABSTRACT: Many new communication applications become reality thanks to integration of computer and telecommunication technologies. A distinctive key element in computer-based communication systems is an additional switching bus. Several different standards exist today for computer telephony buses. Testing and evaluation of communication systems built

to the computer telephony standards is an important aspect of the development. The presented article describes main particularities, basic requirements and timing evaluations of testing in computer telephony systems with H.100 and MVIP90 standard switching buses. The computer telephony bus tester is designed using a digital signal processor and integral bit error tester devices. The general principles of testing methods, block diagrams of tester equipment and software architecture are discussed. (pp. 74-81)

Burovs G. Topological models of information technologies of discrete processing of signals

Riga Technical University, Institute of Information Technology, Latvia

ABSTRACT: The application of topological principles in models of signals discrete processing is considered. In them the information mapping operators with properties of topological invariancy are used (Burovs 2001). The optimization of identification models is carried out at the expense of parameters adjustment of the information mapping operators. They are formed of regressive models parameters and dynamic discrete parameters. It allows to strengthen the quasi-isometric models property and to increase accuracy of the signals parameters estimation. The numerical experiment of processing of 6 order dynamic process has confirmed efficiency of the offered information technologies. (pp. 82-93)

Burovs G.1) and A. Varslavs2) Algorithms of identification of regressive models parameters with use of the making operator

1) Riga Technical University, Institute of Information Technology, Latvia

2) Unibank, Riga, Latvia

ABSTRACT: The identification task of analog dynamic objects and processes with use of regressive models (RM) is examined. The regression parameters are calculated by the decision of difference equations systems. They turn out as dimensionless values. They have a discrete nature, as depend on ways of discrete processing of analog signals and of their access period ?. The constraint of regression parameters with the physical characteristics of object is shown in the ciphered kind. Therefore they are difficult for using in tasks of technical objects control and optimization of economic processes. In work the transformation algorithm of regression parameters RM in estimates of the object analog operator is developed. Last more precisely present the object physical properties. The algorithm is generated as mapping operation of the

generating discrete operator of RM (GORM) in the analog operator. It is the inverse type task. Therefore regular properties of algorithm are sensitive to influence of the interfering factors. The reasons of their infringements are investigated. The alternative approached algorithm is developed. With the purposes of reliability increase of identification estimates is offered to share with exact algorithm. (pp. 94-100)

Burovs G.1), I. Iltins2) and M. Iltina2) Statistical regularization of identification algorithm

1) Institute of Information Technology, Riga Technical University, Latvia

2) Institute of Engineering Mathematics, Riga Technical University, Latvia

ABSTRACT: The use of identification algorithms (IA) described in Iltins & Burov (2000) often leads to solution of badly determined equation systems. It creates an unpredictable influence of errors to the calculated result. There is described a possibility to improve the stability of the computing process using the statistical regularization in it. It is a variant of the well-known Monte-Carlo method. As it is shown in the article, it is possible to use IA in cases, where it would not be possible to use them earlier without the help of the statistical regularization method. (pp. 101-108)

Spalvins A., Slangens J., Janbickis R., Lace I., Eglite I., Skibelis V. and A. Macans Know - how technologies developed for modelling hydrogeological processes

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: Since 1993, the team of the Environment Modelling Centre (EMC) of the Riga Technical University has been active in developing special software for creating hydrogeological models (HM). These new tools have been applied in conjunction with commercial ones for solving practical problems regarding drinking water supply and dynamics of contaminated groundwater. The new software tools and main projects EMC has dealt with are considered. (pp. 109-123)

Spalvins A., Slangens J., Janbickis R. and I. Lace Modelling of dissolved oil product migration in groundwater at the former Rumbula airbase, Latvia

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: To estimate the risk caused by migration of dissolved in groundwater jet fuel products to the Daugava river, the 3D-hydrogeological model (HM) has been created for the former Rumbula airbase. The nearby Getlini waste disposal site is also included. Due to a bioremediation, only a small part of fuel reaches Daugava. Contaminants coming from Getlini are mostly caught by two ditches falling into this river. (pp. 124-137)

Spalvins A., Slangens J., Janbickis R. and I. Lace New subsidiary tools for the modeling system REMO

Environment Modelling Centre, Riga Technical University, Latvia

ABSTRACT: New subsidiary software tools have been developed for the modeling system REMO. These tools may be used for formulating hydrogeological models (HM) and for computing balance of 3D groundwater flows. (pp. 138-142)

Spalvins A.¹⁾, J. Slangens¹⁾, R. Janbickis¹⁾, I. Lace¹⁾ and P. Hein²⁾ Modelling of groundwater flow dynamics and contaminant transport processes for the Bernau area, Germany

1) Environment Modelling Centre, Riga Technical University, Latvia

2) Hydrogeological company INGAAS GmbH, Germany

ABSTRACT: The Bernau place in Germany is heavily polluted with tetrachlorethane. To help in solving the remedy problem of the place, a system of hydrogeological models (HM) has been developed by the Environment Modelling Centre (EMC) of the Riga Technical University. (pp.143-154)