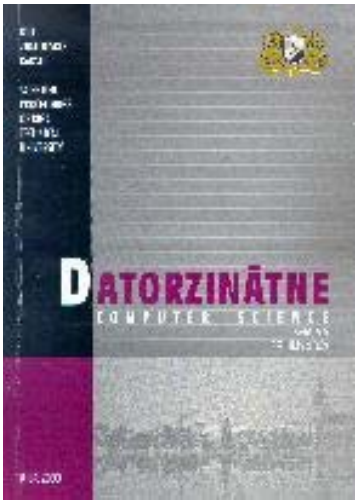

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Abstracts

Morimoto A., Shimano Y, Ashino R., Vaillancourt R.WAVELETS AND BLOCK SINGULAR VALUE IMAGE DENOISING

A new hybrid method consisting of a discrete wavelet transform and a spline block singular value decomposition denoising procedure is proposed and used to remove Gaussian noise from images. Noise filtering is performed in the singular value and singular vector domains as follows: apply a two-dimensional discrete wavelet transform to a given image to get four sub-images: one approximation and three details; then apply a spline block singular value denoising with a spline weighting function to the approximation and apply a spline block singular value denoising with straight lines to the three details; finely, apply the two-dimensional inverse discrete wavelet transform to the processed approximation and the processed details to get the denoised image. A priori knowledge of the noise variance is not required because an estimate of the singular value noise variance is performed during the first phase of the procedure. Filtering is based on eliminating changes in singular values and singular vectors caused by additive Gaussian white noise or other types of noise. Processing the image in smaller blocks makes the SVD procedure computationally feasible. Numerical treatment of images illustrates the efficiency of the method.

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Sharp P.W., Vaillancourt R. New Nystrom pairs for the general second-order problem

We use three different approaches to derive new families of explicit Runge-Kutta Nyström pairs of order 3-4, 4?5 and 5-6 for the general second-order initial value problem. Our aim is two-fold: to add significantly to the theory of Nyström pairs and to obtain pairs that are more efficient and just as reliable as existing pairs. (pp. 15-24)

Vaillancourt R., Zakharov V.G. Biorthogonal wavelet bases for solving time-dependent partial differential equations.

We consider numerical methods for solving time-dependent PDEs using biorthogonal wavelet bases adapted to differential operators. We demonstrate how operator-adapted wavelets provide diagonal stiffness matrices and can supply efficient algorithms for solving linear and

nonlinear PDEs. We outline constructive methods to obtain wavelets adapted both to monomial differential operators and to sum of differential operators with constant coefficients. We introduce an original approach to construct wavelets, that form biorthogonal bases on an interval, adapted to monomial differential operators. These wavelets allow one to satisfy homogeneous Dirichlet boundary conditions. A generalization of interval wavelets adapted to sums of differential operators is discussed. Using operator-adapted wavelets we present a method that avoids the inversion of operator (matrix) in the left-hand side of implicit time-integration numerical schemes. Several numerical examples of solving time-dependent PDEs illustrate the discussed approaches. In particular, numerical examples demonstrate the stability of the implicit time-integration schemes versus the explicit ones (pp. 25-52)

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During 1935-1990, the Bernau place (not far from Berlin) has been polluted with trichloretilene (TCE). It is a dense non- aqueous liquid, sinking in groundwater. In 2001, the German company INGAAS GmbH has started a cleaning plant project for in-site remediation of contaminated groundwater. At the initial stage of the project, data about hydrogeological conditions and contamination of the place were scarce. For this reason, the hydrogeological model of the place was based on false interpretation of factors controlling the groundwater flow there. In 2005, new data was obtained. They enabled to understand much better the complex hydrogeological situation of the place. It was possible to correct the original model, in order to simulate the TCE migration by accounting for the ample monitoring data obtained recently. (pp. 120-129)

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Protection and sustainable use of water must be planned at river basin and subbasin scales. Models of river basins should be created to develop strategies and scenarios for management of water systems. The territory of Latvia is covered by four transboundary river basins and their management is complex. Software tools have been developed for modelling components of hydrological cycle and water systems of large towns. For deep confined aquifers the river basin concept is not valid. Serous problems arise when transboundary models should be created because no data about the cross-boundary zone are available. (pp. 130-136)

Spalviņs A., Slangens J., Janbickis R., Lace I., Eglite I., Skibelis V., Macans A., Juhna T.: APPLICATION OF HYDROGEOLOGICAL MODEL OF THE BALTEZERS, REMBERGI AND ZAKUMUIZA WATER SUPPLY COMPLEX FOR ESTIMATION OF ITS CONTAMINATION PROCESSES

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G. Burov. Application of switching circuits with changeable configuration for parallel processing of numerical information

The problem of formation of switching algorithms in computing systems is considered using the problem of calculation of permanents of associative matrixes as an example. The basic attention is given to the development of program methods of management of switching circuits. It is shown that the application of the principle of modular decomposition of working algorithm allows to represent the switching circuit in the form of association of independent local switching circuits with more simple structure. It allows to apply independent local switching circuits which should be connected to data carriers in each of modules. It is expedient to apply mode of monitoring, during which the updating of programs of switching is made to optimize the calculations. For the coordination of functioning of working algorithm and the algorithm of switching it is offered to use a uniform description in the form address lexicographic combinatory configurations. To reduce the amount of calculation it is offered to use information-compressed forms of algorithms of local switching. Parallel processing of numerical information in this case can be used. Application of generating operators in algorithms allows to apply program methods to manage the architecture of switching circuits. (pp. 149-161)

G. Burov. Systolic mode based optimization of numerical information processing algorithms.

The problem of organization of systolic modes of processing of numerical information is considered, using the calculation of permanents of associated matrixes of equation systems as an example. It is offered to solve in analytical way on the basis of decomposition of address lexicographic combinatory configuration (ALCC) of the working algorithm into separate modules. That allows to apply local switching circuits with more simple structure. Methods for creating information-compressed forms of ALCC and ways of their realization using algorithms for sampling components of carriers in each module are considered. Methods for creating formalized lexicographic address matrixes used for assembly of separate modules into unified system are developed. It is shown, that for the organization of systolic modes it is expedient to use recursive and regular properties of working algorithms. The developed methods allow to coordinate the functioning of arithmetic devices and devices of information storage. (pp. 162-172)

Aleksans O. Detection of the LNAPL actual thickness, problems and their possible solutions.

On the conditions of a diphase liquid presence in the groundwater aquifer numerous geological, hydro-geological and physical factors takes impact, which interaction influences a spatial arrangement of groundwater and non aqueous phase liquid levels. As a result of researches it is proved, that, on the basis of spatial modelling and computer analysis of groundwater and non aqueous phase liquid levels by means of Golden Software Inc. program SURFER it is possible to detect actual thickness of a layer of a free phase liquid in the groundwater aquifer. The data certain in a similar way, have high correlation with parameters which are received by empirical calculations and obtained from the pumping test results, which specifies interchange ability of these methods in applied and scientific researches. Method is better to use for sites of diphase pollution by hydrocarbons where thickness of a non aqueous phase liquids in a point of its greatest thickness reaches minimally 0.5 meters, for more thin layers the received result will be rather approximate. The exact spatial binding of points of measuring is necessary for realization of a method on coordinates X, Y and, especially - Z, and also the mistake of measuring should not exceed 1 centimetre. (pp. 173-182)

Juhna T., Kolushin A,. Lukjaneca I., Nazarovs S., Rubulis J., Spalvins A. COMPARISON OF BACTERIA GROWTH SIMULATION RESULTS FOR WATER DISTRIBUTION NETWORK AND "PROPELLA" TYPE REACTOR ...

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El-Nabulsi R.A., Dzenite I.A., Torres D.F.M. Fractional action functional in classical and quantum field theory.

Non-conservative equations of motion are analysed using a fractional action-like variational approach with one parameter . The analysis is done within the Lagrangian and Hamiltonian frameworks, both for classical and quantum field theories, by treating the action as a Riemann-Liouville fractional integral. The natural extension of this approach to quantum systems is stated and discussed. (pp. 189-197)

Hajji M.A., Vaillancourt R. Matrix derivation of Gaussian quadratures.

An efficient algorithm is proposed to compute the nodes and weights of Gaussian quadratures to approximate weighted definite integrals. The algorithm, which is based on the symbolic or machine-precision computation of the weighted moments, converts the problem into an equivalent eigenvalue problem for a symmetric tridiagonal matrix whose eigenvalues are the required nodes. The weights are found in terms of normalized eigenvectors. Numerical examples illustrate the efficiency and accuracy of the proposed algorithm. The eigenvalues and eigenvectors are computed by means of the QR algorithm with shifts. (pp. 198-213)