# ПУБЛИКАЦИИ ОСНОВНЫХ РЕЗУЛЬТАТОВ НАУЧНОЙ ДЕЯТЕЛЬНОСТИ СОТРУДНИКОВ ИНСТИТУТА МАТЕМАТИКИ И ИНФОРМАТИКИ В РЕЙТИНГОВЫХ ЖУРНАЛАХ, ИНДЕКСИРУЕМЫХ В БАЗАХ ДАННЫХ WEB OF SCIENCE / SCOPUS ЗА ПЕРИОД С 2017 ПО 2020 гг.

1. Maria Vasilyeva, Sergei I. Stepanov, Vasiliy Vasil'ev. Multiscale Finite Element Method for heat transfer problem during artificial ground freezing //Journal of Computational and Applied Mathematics. – 2020. – Vol.371. – 112605. DOI:10.1016/j.cam.2019.112605. Базы данных: WoS/Scopus. Квартиль: Q2.

Аннотация:

In this work, we consider the heat transfer problem during artificial ground freezing. We present the mathematical model and the fine grid approximation for heterogeneous porous media, where freezing pipes are considered as line source terms. Mathematical model is described by a two-phase Stefan problem. Fine grid approximation is performed using a finite element method. The main goal of the work is the construction of the coarse grid approximation using the Generalized Multiscale Finite Element Method (GMsFEM). In GMsFEM, we solve local spectral problem in order to determine main heat flow characteristics in the heterogeneous porous media and construct special additional multiscale basis functions in order to perform an accurate approximation of the line source terms (freezing pipes). We present numerical results for two heat transfer model problems in the two and three-dimensional formulations and investigate accuracy of the proposed multiscale methods for different numbers of the multiscale basis functions.

2. Nyrgun P. Lazarev, Natalia A. Romanova, Galina M. Semenova. Optimal location of a thin rigid inclusion for a problem describing equilibrium of a composite Timoshenko plate with a crack //J Inequal Appl. – 2020. – Vol. 29. Базы данных: WoS/Scopus. Квартиль: Q1.

Аннотация:

We consider equilibrium problems for a cracked composite plate with a thin cylindrical rigid inclusion. Deformation of an elastic matrix is described by the Timoshenko model. The plate is assumed to have a through crack that does not touch the rigid inclusion. In order to describe mutual nonpenetration of the crack faces we impose a boundary condition in the form of inequality on the crack curve. For a family of appropriate variational problems, we analyze the dependence of their solutions on the location of the rigid inclusion. We formulate an optimal control problem with a cost functional defined by an arbitrary continuous functional on the solution space, while the location parameter of inclusion is chosen as the control parameter. The existence of a solution to the optimal control problem and a continuous dependence of the solutions in a suitable Sobolev space with respect to the location parameter are proved. © 2020, The Author(s).

3. Vasiliy V. Grigoriev, Oleg Iliev, Petr N. Vabishchevich. Computational identification of adsorption and desorption parameters for pore scale transport in periodic porous media // Journal of Computational and Applied Mathematics. – 2020. – Vol.370. DOI:10.1016/j.cam.2019.112661. Базы данных: WoS/Scopus. Квартиль: Q1.

Аннотация:

Computational identification of unknown adsorption and desorption rates is discussed in conjunction with reactive flow considered at pore scale. The reactive transport is governed by incompressible Stokes equations, coupled with convection–diffusion equation for species transport. The surface reactions, namely adsorption and desorption, are accounted via Robin boundary conditions. Henry and Langmuir isotherms are considered. Measured concentration of the specie at the outlet of the domain has to be provided to carry out the identification procedure. Deterministic and stochastic parameter identification approaches are considered. The influence of the noise in the measurements on the accuracy of the identified parameters is discussed. Multistage identification procedure is suggested for the considered class of problems. The proposed identification approach is applicable for different geometries (random and periodic) and for a range of process parameters. In this paper the potential of the approach is demonstrated in identifying parameters of Langmuir isotherm for low Peclet and low Damkoler numbers reactive flow in a 2D periodic porous media with circular inclusions. Simulation results for random porous media and other regime parameters are subject of follow up papers. Finite element approximation in space and implicit time discretization are exploited.

4. Michael V. Klibanov, Aleksandr E. Kolesov, Dinh-Liem Nguyen Convexification Method for an Inverse Scattering Problem and Its Performance for Experimental Backscatter Data for Buried Targets // SIAM J. Imaging Sci. – 2019. – Vol.12(1). – P. 576–603. DOI:10.1137/18M1191658. Базы данных: WoS/Scopus. Квартиль: Q1.

Аннотация:

We present in this paper a novel numerical reconstruction method for solving a three-dimensional inverse scattering problem with scattering data generated by a single direction of the incident plane wave. This problem is well known to be a highly nonlinear and ill-posed problem. Therefore, optimization-based reconstruction methods for solving this problem would typically suffer from the local-minima trapping and require strong a priori information of the solution. To avoid these problems, in our numerical method, we aim to construct a cost functional with a globally strictly convex property, whose minimizer can provide a good approximation for the exact solution of the inverse problem. The key ingredients for the construction of such a functional are an integro-differential formulation of the inverse problem and a Carleman weight function. Under a (partial) finite difference approximation, the global strict convexity is proven using the tool of Carleman estimates. The global convergence of the gradient projection method to the exact solution is proven as well. We demonstrate the efficiency of our reconstruction method via a numerical study of experimental backscatter data for buried objects.

5. Alexander V. Avvakumova, Valery F. Strizhovb, Petr N. Vabishchevichb, Alexander O. Vasilev. State change modal method for numerical simulation of dynamic processes in a nuclear reactor // PROGRESS IN NUCLEAR ENERGY. – 2018. – Vol.106. – P. 240-261. DOI: 10.1016/j.pnucene.2018.02.027. Базы данных: WoS/Scopus. Квартиль: Q1.

Аннотация:

Modeling of dynamic processes in nuclear reactors is carried out, mainly, on the basis of the multigroup diffusion approximation for the neutron flux. The basic model includes a multidimensional set of coupled parabolic equations and ordinary differential equations. Dynamic processes are modelled by a successive change of the reactor states, which are characterized by given coefficients of the equations. In the modal method, the approximate solution is represented as an expansion on the first eigenfunctions of some spectral problem. The numerical-analytical method is based on the use of the dominant time-eigenvalues of a multigroup diffusion model taking into account delayed neutrons. In this work, the application of the modal methodology based on calculation of the dominant eigenvalues and eigenfunctions of α-eigenvalue problem has been tested for the VVER-1000 reactor test model. The last is characterized by the fact that some eigenvalues are complex. Reactor dynamics behavior is simulated for symmetrical and non-symmetrical control rods insertion/withdrawal. The power calculation results obtained with the modal method were compared with the numerical solution of the dynamics problem. A rather good agreement was shown for the problem with single delayed neutron precursor group.

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