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Инженерный факультет
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ЭКОНОМИКА, ТЕХНОЛОГИИ И ПРАВО В СОВРЕМЕННОМ МИРЕ

Материалы Международной научно-практической конференции факультета экономики и права и инженерного факультета

(Барановичи, 20 октября 2016 года)

Барановичи
БарГУ
2017

УДК 001(063)

В сборнике представлены материалы, затрагивающие широкий круг вопросов, посвященных эффективному экономическому развитию организаций и регионов, маркетингу и менеджменту. Особое внимание уделено проблемам применения и совершенствования национального законодательства. Раскрываются теоретические и практические результаты научного поиска авторов по инженерному профилю, затрагивается проблемное поле современной физики и математики. Материалы носят как теоретический, так и практико-ориентированный характер

Издание предназначено для преподавателей, студентов, магистрантов, аспирантов и научных работников.

ISBN 978-985-498-756-9

Список цитируемых источников

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UDC 004.02

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SOLUTION OF REGIONAL TASKS BY NUMERICAL METHODS

Introduction. The model of any represented process, because of its extreme complexity, has to cover major for the considered task of the party of process, his essential characteristics and the formalized communications that are subjected to the account.

As a rule, the mathematical model describing difficult production process can be presented in the form of the equations of mathematical physics. Most often, it is the differential equations in private derivatives containing a large number of unknowns and parameters.

With the advent of the COMPUTER the solution of the production tasks is presented in the form of the computer models realized by numerical methods. The computing experiment allows to cut down considerably material and temporary expenses in comparison with a natural experiment, and to receive rather exact adequate results of the decision, objectives. As the COMPUTER carries out only arithmetic and logical operations, the realization of computing model requires the development of the corresponding computing algorithm or the program for calculation on the COMPUTER, with the subsequent processing of results of calculation.

Main part. Let it is necessary to solve the system of the ordinary differential equations (ODE) which is written down in a vector look:

$$E(z)\frac{d^2\vec{u}}{dz^2}+Q(z)\frac{d\vec{u}}{dz}+G(z)\vec{u}=\vec{\tilde{f}}(z)$$

Boundary conditions:

$$\alpha^0(-3u_{1,j}+4u_{2,j}-u_{3,j})+2h_z\beta^0u_{1,j}=2h\gamma^0;\ \alpha^L(3u_{n+1,j}-4u_{n,j}+u_{n-1,j})+2h_z\beta^Lu_{n+1,j}=2h_z\gamma^L.$$

For the solution of a regional task we will choose in compliance [1] on an interval $\{0\le z\le L\}$ uniform grid $\varpi_{hz}=\{z_i=(i-1)h_z,\ h_z=L/n,\ i=1...n+1\}$.

For calculations, we use the final and differential central scheme of the second order of accuracy:

$$E_i\frac{\vec{u}_{i-1}-2\vec{u}_i+\vec{u}_{i+1}}{h_z^2}+Q_i\frac{\vec{u}_{i+1}-\vec{u}_{i-1}}{2h_z}+G_i\vec{u}_i=\vec{\tilde{f}}_i;\ \ i=2..n.$$

After the reduction of similar members, we will receive a system of linear equations (SLE):

$$(E_i-\frac{h_z}{2}Q_i)\vec{u}_{i-1}+\left(-2E_i+h_z^2G_i\right)\vec{u}_i+\left(E_i+\frac{h_z}{2}Q_i\right)\vec{u}_{i+1}=h_z^2\vec{\tilde{f}}_i.$$

Let's present to SLE for the final and differential scheme in a look $A\,\vec{x}=\vec{d}$.

Matrix A has dimensions $k \times k$, $k = (n + 1)(m + 1)$ and the block and tape structure with poorly filled matrixes of the blocks from [1]. Vector of the right parts $\vec{d}$ has an appearance (for boundary conditions with $a^{1,2}\neq 0$):

$$\vec{d} = \{\gamma^0 .. \gamma^0, f_{1,0} + p\gamma^1, f_{1,1}, .. f_{1,m-1}, f_{1,m} + p\gamma^2, .., f_{n+1,0} + p\gamma^1, f_{n+1,1}, .. f_{n+1,m-1}, f_{n+1,m} + p\gamma^2, \gamma^L .. \gamma^L\}.$$

The technique of the decision of SLE considered in the report with the block tape matrix is an economic modification of the method of Gauss with the choice of the main element — the method of a block matrix pro-race [1]. The idea of an algorithm consists in implementation of the method of Gauss on the packed massif to which not zero block elements of matrixes are located. As in the case under the consideration matrixes of G and Q are poorly filled, along with the packaging to tape massifs, the algorithm of the packaging only of nonzero elements to the massif from one-coherent dynamic stacks was developed.

As tests of the developed algorithms two tasks are solved: the regional task for the wave equation of Helmholtz in cylindrical system of coordinates and the regional task for the heat conductivity equation describing temperature condition in a layer of the liquid moving between two planes.

Conclusion. Thus, two program modules containing a set of the methods of a class realizing Gauss's algorithm on the packed matrix in the form of the massif from stacks and in the form of the tape massif are developed. Numerous calculations on the sequence of grids showed absolute resistance and convergence to the exact decision according to the approximation of the second order of the offered algorithm. The algorithm to the massif from the stacks for the considered task works with the packaging at 15-30 times quicker.

By way of the illustration opportunities of the method, a number of tasks for a case of a longitudinally irregular wave-guide is solved [2; 3].

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