
FEATURES OF APPLICATION OF THE AMDAHL’S LAW AND THE GUSTAFSON – BARSIS’S LAW FOR THE EVALUATION OF THE MAXIMUM SPEEDUP OF COMPUTATIONS IN FORECASTING OF RADIONUCLIDE’S SPATIAL MIGRATION IN NATURAL DISPERSE ENVIRONMENT

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Features of application of the Amdahl’s law and the Gustafson – Barsis’s law for calculation of the maximum speedup of computation and evaluation of the effectiveness of parallel computing algorithms in solving problems of forecasting of radionuclide’s spatial migration in natural disperse environment are considered.

Keywords: parallel computing, parallel algorithms, Amdahl’s law, Gustafson – Barsis’s law, forecasting of radionuclide’s migration.

In previous works [1, 2] authors developed the parallel computational algorithms which were subsequently implemented in a software module for forecasting of radionuclide’s spatial migration in natural disperse environment, which is a part of the SPS (Simulation Processes in Soil) software package [3]. To evaluate the effectiveness of the developed computational algorithms and to calculate the maximum speedup of computation the Amdahl’s law was used [4], however, in some cases, the Gustafson – Barsis’s law could be used for such purposes instead [5].

The maximum possible speedup of computation of forecasting the radionuclide’s spatial migration in natural disperse environment, calculated according to Amdahl’s law, shows the difference between the time of execution of the program in parallel mode and the time of its execution in sequential mode with the same initial data. The maximum possible speedup of computation, calculated according to the Gustafson – Barsis’s law, shows how efficiently can the parallel mode of the program execution be organized in the conditions of changing the initial data and increasing the complexity of the task. Therefore, Amdahl’s law allows to analyze the efficiency of computations parallelization and the Gustafson – Barsis’s law allows to analyze the operation of a parallel program without taking its sequential mode into account.

The necessity of the Amdahl’s law application for the analysis of parallel computational algorithms in the developed software [3] is explained by the fact that these algorithms were obtained by parallelizing sequential algorithms. However, given the fact that prior to the development of a software module [3], there was no specialized software for forecasting of radionuclide’s spatial migration based on the parallel computing technologies, its analysis using the Gustafson – Barsis’s law is an actual goal.

BIBLIOGRAPHY

EFFECTS OF CURRENT ECOLOGICAL FACTORS ON PINUS SYLVESTRIS IN THE "BELOVEZHSKAYA PUSHCHA" NATIONAL PARK

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In the modern world human induced and climatic factors severely affect all the components of the environment significantly harming vegetation, especially Pinus sylvestris (L.). Both mobile (i.e. vehicles) and stationary sources of pollution (i.e. industry and agriculture) contribute to anthropization. It is also worth mentioning the con-stantly changing environmental conditions and the emergence of a steppe, which is a new climatic zone in the southern part of Belarus. Belovezhskaya Pushcha due to its geographic location and the wind rose undergoes all the foregoing negative environmental impacts, the effect of which is likely to increase in the future.

Keywords: anthropization, climate, pollutants, Belovezhskaya Pushcha, Pinus sylvestris (L.).

Pinus sylvestris (L.) is the predominant tree species of Belovezhskaya Pushcha, but in current ecological conditions it undergoes a significant negative impact due to the climate getting drier and warmer, the growth and development of the most adapted to these climate plant species; and as a result of a pronounced technogenic impact stemmed from industrial regions of Germany and Poland and least from Belarus and Russia. In the future all these factors can lead to the elimination of pines from forest stands not only in Belovezhskaya Pushcha, but also throughout Belarus and surrounding countries [1].

Drying and natural succession of Pinus sylvestris (L.) gradually leads to it being replaced by Picea abies (L.), which periodically dries out massively due to climatic changes, which necessitates sanitary cutting. Consequently, frequent felling (sometimes even not quite rational) combined with the lack of pine reproduction have a negative effect on the forest ecosystem and beneficially affect the growth of the most adapted and aggressive vegetation. The current state of the pine stand is lower than satisfactory, which is caused by a reduced tolerance to environmental factors, the development of fungal phytopathologies, the low stand density, and the introduction of degressive edificators such as spruce and hornbeam [1].

Both Polish and Belarusian territory of Belovezhskaya Pushcha as well as almost the entire territory of Belarus, is a continuous zone contaminated with sulfur-containing substances, mainly coming through the border from industrial centers of Germany and Poland. With reference to heavy metals, only zink (Zn) and lead (Pb) fully cover the territory, the remaining elements have a local distribution pattern [1, 2].

Due to its sensitivity to technogenic and anthropogenic factors, Pinus sylvestris (L.) is considered an important bioindicator. Pine needles are capable of uptaking and accumulating pollutants, thus the content of which can be determined. For example, a research undertaken previously studied the heavy metal content in two-year-old needles of Pinus sylvestris (L.) and revealed the indices far from toxic, however, the concentration of heavy metals in the samples from the western regions of Poland was slightly higher than in those from Belarus. This shows a significant contribution of Western countries’ industry to the pollution of Belovezhskaya Pushcha. Furthermore, the zones with a relatively high concentration of heavy metals in forest vegetation were insignificantly small and locat-ed mainly near settlements and small industrial enterprises [2].

Thus, the problem exists both in the Polish and Belarusian territories of Belovezhskaya Pushcha and requires a solution.

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