

NEW ALGORITHMS AND DATA STRUCTURES FOR EFFICIENT IMPLEMENTATION OF NUMERICAL SCHEMES IN C++23 PROGRAMMING LANGUAGE STANDARD

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Abstract: The new version of the standard for the C++ programming language and its standard template library, released at the end of 2023, includes new algorithms and data structures. The paper reports the usage of some of the new features: multidimensional arrays (`std::mdspan`) and linear algebra library functions (`std::linalg`). With their help, new opportunities are opened for accelerating numerical schemes for scientific computing, including simulation of combustion problems on personal computers and high-performance clusters. It is shown that the introduction of new functions allows to significantly reduce the cost of designing, writing and debugging the code which can be object-oriented and enables reuse on different architectures. At the same time, the computational performance remains at the same low level of procedural approaches to programming in the style of the C language. As an example of application of these capabilities, the results of modeling the ignition of a square angle by a surface of constant temperature are presented.

Keywords: combustion theory; numerical simulation; optimization; C++ programming language in scientific calculations

DOI: 10.30826/CE24170112

EDN: YDLTMH

Figure Captions

Figure 1 Temperature distribution along the right-angle axis at different moments of time (1–6) and at the moment of ignition (7)

Figure 2 Temperature contour inside the right angle at the moment of ignition

Acknowledgments

The work was carried out within the framework of the Program of Fundamental Scientific Research of the Russian Federation “Combustion and Explosion Processes” (Registration No. 122040500073-4) and had budget funding.

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Received January 22, 2024

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