ACCELERATION OF NUMERICAL SCHEMES FOR SIMULATION OF PULSED COMBUSTION USING NEW FEATURES OF C++ PROGRAMMING LANGUAGE

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Abstract: The performance of numerical schemes was studied for modeling ignition and pulsed combustion on a personal computer using new features of the C++ programming language. The model problem of initiation and subsequent propagation of a combustion front in a reactive solid, where pulsating and chaotic regimes are possible, was considered. Estimates are provided for the influence of various factors included in the modern standard of the C++ programming language and the standard template library such as standard containers and algorithms in common and concurrent multithreaded implementations. Options for enhancing performance are proposed by comparison of concurrent processing algorithms and approximating the exponential term in the combustion equations. It is shown that the performance of a numerical scheme is significantly affected by hardware caching which, in turn, should be taken into account when choosing the algorithm.

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

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Figure Captions

Figure 1 Exponential function approximation (*1*) by an empirical expression (*2*)

Figure 2 Distribution of temperature (*a*) and concentration (*b*) at the moment of the occurrence of the peak of the pulsed combustion wave

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