Proceedings of CHT-17
ICHMT International Symposium on Advances in Computational Heat Transfer

May 28-June 1, 2017, Napoli, Italy

CHT-17-300

SIMPLIFIED APROACH FOR NUMERICAL CALCULATION OF THE HEAT FLOWS AT DETONATION COMBUSTION

Svetushkov Nikolai N.[*,§]
[*]Moscow Aviation Institute (National Research University), department «Applied mathematics and physics», Moscow, Russia
[§]Correspondence author. Fax: +7 499 158 47 42 Email: svetushkov@mai.ru

ABSTRACT This paper investigates the possibility of calculating the thermal loads on the walls of the combustion chamber during combustion detonation, which is important in the development of industrial detonation engines, including spin detonation and burning. For the calculation was proposed simplified mathematical model based on the parabolic partial differential equations, which reflects the main features of the propagation of a detonation wave in the combustion chamber. The article is detailed derivation of this equation, and the key assumptions used in its preparation. To solve the resulting equations and numerical calculations by the authors used a new approach - a method of strings based on the integral representation of the heat equation. The article shows the advantages of the proposed approach and noted that its use avoids the "nonphysical" oscillations in the numerical solution in the case of large temperature gradients. For the purpose of calculation it was modified previously developed software environment that allows you to create two-dimensional model of the combustion chambers, with regard to their configuration, and set the initial and boundary conditions. The results presented showed that by varying the available parameters of the model can change the shape of the plume and the nature of the temperature field in the vicinity of the detonation wave to better compliance with the experimental results. The article concludes that the effectiveness of this approach in terms of minimizing the computational cost and a series of numerical experiments to optimize the combustion chamber. The developed code can be useful for technicians who expect the thermal load of detonation combustion chambers.