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Tracking Methods to Study the Surface Regression of the Solid-Propellant Grain

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Abstract

In the work, we have successfully developed practical surface tracking methods to calculate the erosive volume and the associated burning areas which are the important parameters to solve a nonlinear, pressurization-rate dependent combustion ballistics. Three methodologies, namely the front tracking, the emanating ray and the least distance methods, are proposed. The front tracking method is based on the Lagrangian point of view; while both the emanating ray and the least distance methods are formulated from the Eulerian viewpoint. Two two-dimensional test problems have been examined to compare with the programming complexity, simulation accuracy and required CPU time of the proposed methods. It is found that the least distance method performs superior to the other two methods in numerical respects. The least distance method is implemented with tetrahedron grids to track the outward propagation of a three-dimensional cubic. Comparison between the predicted erosive volume and corresponding theoretical result yields satisfactory agreement.

Keywords: solid propellant surface regression, surface tracking methods, CFD

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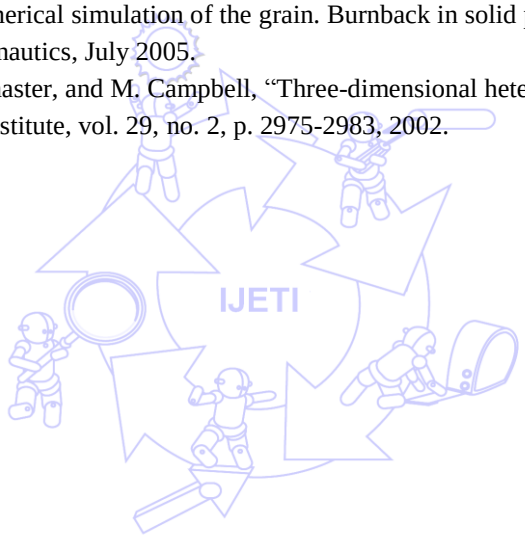

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