

ABSTRACT

A two-dimensional investigation and comparison study was conducted for three models of the Raptor bell-shaped nozzle from SpaceX. The geometry was drawn using SolidWorks and the (CFD) analysis was performed using ANSYS Fluent Solver. Based on the Fluent data, the results of the flow characteristics inside the rocket nozzle and the heat transfer analysis results were presented using MATLAB. The study compared three models, a model without regenerative cooling channel, a model with a conventional regenerative cooling channel, and a modified model with a regenerative coolant inlet located near the nozzle throat. The results generally confirmed the effectiveness of the regenerative cooling channels in significantly reducing the nozzle wall temperatures by 80-95% at different sections of the nozzle. The results also showed that the third model outperformed the second model in reducing the wall temperatures of the throat section, convergent section, combustion chamber section, and parts of divergent section up to 1.1 meters. In the throat section, the cooling percentage of the third model was 89.17%, with a better difference approximately 3.12% compared to the second model. In other words, the second model achieved 86.38% throat cooling.