Development of Predictive Software for the Engineering & Optimization of Reliable Rocket Components

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The purpose of the project was to engineer a more efficient and amateur-friendly software package to aid in the designing of optimal converging-diverging nozzles. The software package was designed using MATLAB® and was equipped with a GUI to make it more user-friendly. The program allows the user to input parameters such as nozzle length, throat diameter, ambient temperatures and pressures, tensile strength of the nozzle material, specific heat ratios, and molecular properties of gasses produced during combustion. These parameters are used by the program to generate a 2D model of the optimized nozzle as well as alert the user of engine failure should the inputted parameters lead to an over-pressurization of the rocket. The program accurately predicted the engine failure of physical tests that the researcher ran. When tested against the Rocketdyne J-2 engine used in NASA's Saturn V launch vehicle, the program generated a nozzle diameter that was only 0.03 m larger than the throat diameter of the J-2; well within the predicted margin of error. The software compensates for its inaccuracies such as that in the preceding sentence by outputting error approximations based on geometric assumptions that result in angles having radii greater than or equal to the radius of the nozzle.

Awards Won:
American Institute of Aeronautics &amp Astronautics: Third Award of $1000.00