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Author: Mr. Roy Ramirez
Purdue University, Costa Rica

Mr. Olman Quiros Jimenez
Instituto Tecnológico de Costa Rica (TEC), Costa Rica

# THE ROCKET ENGINE DESIGNER: DEVELOPING AN ACCESSIBLE, USER-FRIENDLY SOFTWARE FOR THE DESIGN OF VARIOUS PROPULSION SYSTEMS

**Abstract**

Although there are many software tools that help designing and simulating rocket engines, some of them are extremely expensive, non-user-friendly, and others only focus on specific areas of propulsion such as commercially available solid rocket motors. A software that incorporates the theory behind several rocket propulsion systems, covers all design stages, and is accessible to academia, would be an effective way of facilitating the design process and promoting the study of rocket propulsion worldwide.

This paper describes the progress on the development of an original software, the Rocket Engine Designer (RED), and how it is planned to incorporate various functionalities that would make it a valuable tool for the study of propulsion systems among the engineering and academic community. The RED is programmed in Python 3.5 and utilizes a user-friendly graphic interface to allow the user to input parameters and visualize the engine as it is being designed. The RED can use thermochemical data from NASA's CEARUN html and text files to solve the rocket equations of a liquid rocket engine. The software links with spreadsheets to produce and manipulate data that can be saved later as project files. The RED outputs several functions that help the user to optimize the engines, such as specific impulse vs. mixing ratio, dimensions vs. chamber pressure, and dimensions vs. thrust. The software allows to choose between a conical or a bell nozzle and calculates the nozzle contour equations. The equations for the design of the injection and feed system are currently being implemented. This paper focuses on describing the functionalities mentioned above, and those that are to be included such as theoretical heat transfer, cooling systems, and upgrading the platform to solid and hybrid propulsion systems.