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EXPERIMENTAL PARAMETRIC STUDY OF ROCKET GRAIN CONFIGURATION ON POTASSIUM NITRATE PROPELLANT WITH ADDITIVES EMPLOYING ROCKET MOTOR DESIGN COMPUTATIONAL FLUID DYNAMICS

Abstract

'Rentabilité' or cost-effectiveness is the chase in the current era of space exploration. The design, build, test and launch of rockets is primarily dependent on the thrust that is delivered by the rocket engine during the flight. Significant research has been conducted in the past to understand the fundamental working of rocket engines in amateur rocketry. In order to investigate the effects of energetic additives on fuel that bear the potential to augment the combustion performance of rocket propellants, study of fuel regression rate, mass flux comparison and combustion efficiency is imperative. This paper encompasses the study of combustion sensitivity to various combinations of fuel-additives on rocket motor casing. Additionally, Potassium nitrate is used with various fuels like sucrose, dextrose and sorbitol in different mixture ratios with varied grain configuration to determine the specific impulse, net thrust, mass flux, specific fuel consumption, etcetera. The tests are then ameliorated with the addition of reactive additives on the parametric study of net thrust. The addition is constrained to a significant percentage to avoid blasting of motor due to sudden increase in combustion pressure which lends the upper limit of additive addition based on the experimental result to be discussed. A rocket motor is built to perform the experiments on various O/F combinations. The results are also validated by performing the Computational Fluid Dynamics on the baseline rocket motor design. Thus, while the paper focuses on the study of experimental results, it also delves into their validation with current advanced finite element analysis methodology unraveling the manufacturing of correct rocket motor to be incorporated in future rocket.