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Wall Heat Flux Mapping in Liquid Rocket Combustion Chamber with Different Jet Impingement Angles

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Abstract : The influence of injector attitude on wall heat flux plays an important role in predicting the start-up transient and also determining the combustion chamber wall durability of liquid rockets. In this paper comprehensive numerical studies have been carried out on an idealized liquid rocket combustion chamber to examine the transient wall heat flux during its start-up transient at different injector attitude. Numerical simulations have been carried out with the help of a validated 2d axisymmetric, double precision, pressure-based, transient, species transport, SST k-omega model with laminar finite rate model for governing turbulent-chemistry interaction for four cases with different jet intersection angles, viz., 0^o, 30^o, 45^o, and 60^o. We concluded that the jets intersection angle is having a bearing on the time and location of the maximum wall-heat flux zone of the liquid rocket combustion chamber during the start-up transient. We also concluded that the wall heat flux mapping in liquid rocket combustion chamber during the start-up transient is a meaningful objective for the chamber wall material selection and the lucrative design optimization of the combustion chamber for improving the payload capability of the rocket.

Keywords : combustion chamber, injector, liquid rocket, rocket engine wall heat flux
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