

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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ESTIMATION OF VIBRATION ENVIRONMENT AND STRUCTURAL ASSESSMENT FOR AN
EXPERIMENTAL SEMICRYO ROCKET ENGINE

Abstract

ISRO is developing a high thrust rocket engine, which make use of liquid oxygen and kerosene as propellants. An experimental Semicryo rocket engine (also called power head test article) is configured which consists of a pre-burner, turbo pumps and associated fluid lines except thrust chamber. This paper talks about the structural assessment carried out for this entire assembly. A detailed finite element model was created capturing the geometry and inertia properties accurately. Major loads that act on the engine during hot test include the internal pressure, thrust, thermal and dynamic loads. Since hot test environment is so complex, predicting the dynamic loads is difficult. To address this, vibration measurements from six earlier hot tests of a similar engine were studied in detail after segmenting the data in to three regimes; start transients, steady state and shut down transients. Two types of dynamic force environments: sinusoidal and random were assessed from the above data. Dynamic characteristics of the assembly were quantified in terms of natural frequencies and mode shapes, subsequently predicted the response of the assembly to the expected dynamic environment. Critically stressed locations were found out and modifications were proposed. Loads acting at salient locations and structural margins for different components were also estimated.