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# THERMAL ENVIRONMENT GENERATION AND VERIFICATION FOR ON-GROUND TESTING OF LAUNCH VEHICLE'S FAIRING

**Abstract**

Fairing is a critical part in launch vehicle, protecting the space crafts (usually satellites) from the severe aerodynamic heating during its flight in the atmosphere. The adoption of new complex materials and more integrated structure in rocket fairing design urge the designers and engineers to come up with a solution to verify the material properties and structure strength under extremely harsh thermal environments via both theoretical analysis and on-ground testing.

This paper focuses on several issues critical for on-ground testing implementation, including the generation of a dynamic thermal environment (maximum temperature of 500K, fastest temperature rise rate of 40K/s), the precise temperature control of multi-heating zones, the accurate signal (thermal and mechanical) measurement in high temperature environment and the verification of such environment by simulation based on limited observation data.

A quarts lamp heater (4 zones) is constructed to mimic the thermal environment the rocket fairing may experience. A modified PID control scheme for multi-input-multi-output (MIMO) system is then employed to fulfill the dynamic temperature tracking tasks for these 4 zones. According to the temperature and heat flux measurement on the surface of fairing, it is shown a satisfactory thermal environment is built and further simulations also validate the temperature gradient generated in regions of interest.