Hosters, N.; **Klaus, M.**; **Behr, M.**; **Reimerdes, H.-G.**

Application of a partitioned field approach to transient aerothermal problems in rocket nozzles. (English) Zbl 1391.76266

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Summary: The structural body of a rocket nozzle is dynamically exposed to high thermal and mechanical loads, which are caused by the hot gas flow. The flow field is itself significantly influenced by the shape and temperature changes of the nozzle wall. Additionally, for typical hot nozzle walls thermal radiation cannot be neglected. To ensure reliable results the unsteady aerothermoelastic interaction and the radiation have to be taken into account in computational investigations. A coupling method is proposed which is able to transfer unsteady mechanical and thermal loads from a fluid solver to a structural solver and transfer deformations and surface temperatures back. Especially in early design steps a fast but reliable simulation approach is necessary. Therefore, a solver using reduced structural models is applied. To be able to consider the radiation within the aerothermoelastic simulation, the structural solver is extended by appropriate computational methods. Also the ability to consider temperature dependent material behaviour is implemented. The presented computational results show the capability of the current fluid-structure interaction method to simulate the aerothermal behaviour of a dual bell nozzle. The computational predictions of the structural solver of the temperature field considering external and internal radiation and also considering temperature-dependent material properties are validated against computational results from a commercial FE solver and experiments.

MSC:

76G25 General aerodynamics and subsonic flows
76N15 Gas dynamics, general

Keywords:

aerothermoelasticity; partitioned field approach; axisymmetric shells; rocket nozzles

Software:

ABAQUS; TAU

Full Text: DOI

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