

Challenges of Hypersonic Flight Health-Monitoring

Ali Gülhan

German Aerospace Center (DLR)

Structural Health Monitoring (SHM) is a process for the determination of failures or damages in structures as early as possible. SHM is essential for the development of maintenance procedures and life time prediction of spacecraft. For a reliable monitoring of actual state and life time prediction SHM should monitor key structure parameters by means of periodic measurements, determination of links between measurement data and failure and finally analysis of the data for the prediction of the health state.

In case of hypersonic flight high aerothermal loads limits the number of feasible instruments for health state monitoring of the TPS components and the sub-structure. Therefore the selection of the sensors requires a dedicated pre-flight analysis in terms of thermomechanical loads and qualification tests in ground test facilities. Flight data of successful SHEFEX-I and SHEFEX-II hypersonic flight experiments of DLR showed that with a reasonable care, it is possible to gain reliable data for the design for the future high speed flight vehicles and validation of design tools. Coming flight experiment ROTEX of DLR and RWTH Aachen University will use new generation HM sensors like Fiber Optic Sensing (FOS) and high speed data acquisition systems with a sampling rate up to 2 MHz.