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HEAT FLUX SENSOR FOR SPACECRAFT CHARGING THERMAL PROTECTION

Abstract

In estimating time-dependent heat fluxes of modern composite thermal protection layers the most effective are methods based on solution of the boundary inverse heat transfer problems. The approach to estimate heat fluxes of complex space structure based on methods of ill-posed problem solving were widely analyzed and confirmed efficiency in the development and investigation of modern structure in rocket-space, aircraft, automotive industries, metallurgy, power engineering etc. A new metrological system for thermal analysis of space structure being developed is a combination of sufficiently accurate measurements of primary heat values in testing conditions to the maximum approximate to full-scale conditions and ultimately correct mathematical treatment of experimental data based on the theory of inverse problems. The following main factors have an influence on the accuracy of the inverse heat conduction problem (in sequence of significance): the errors in coordinates of thermocouple positions; the errors in values of different characteristics; the errors in estimating the residual level. It was shown that in the cases considered the accuracy of the inverse problems solution is compatible with the errors of the simulated "experimental measurements". The practical application of developed sensors at ground tests is presented.