Analytic investigation on error of heat flux measurement and data processing for large curvature models in hypersonic shock tunnels. (English) Zbl 07590677 Appl. Math. Lett. 134, Article ID 108342, 8 p. (2022)

Summary: Due to short test time, heat conduction was considered as transient in hypersonic shock tunnels. The heat flux measurement and data processing were operated basing on one-dimensional semi-infinite heat conduction theory. However, for models with local large curvature or small radius, it resulted in significant compression or expansion of space for heat transfer, or lateral heat conduction, which made the hypothesis of one-dimensional unsatisfied and errors. In this paper, approximate solutions for the unsteady heat conduction in cylindrically convex and concave shells were established, and were used for further analysis of the errors, with forms of heating load, location and curvature radius of heated surface taken into consideration.

MSC:

80A19 Diffusive and convective heat and mass transfer, heat flow
80-05 Experimental work for problems pertaining to classical thermodynamics
76K05 Hypersonic flows
44A10 Laplace transform
65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs
80M20 Finite difference methods applied to problems in thermodynamics and heat transfer

Keywords: heat flux; measurement; data processing; error; approximate solution

Full Text: DOI

References:


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