RESPONSE STUDIES OF A TETHERED AEROSTAT BALLOON SUBJECTED TO INITIAL DISTURBANCES

Ajit Kumar; A.K. Ghosh
Department of Aerospace Engineering
Indian Institute of Technology Kanpur
Kanpur-208 016, India
Email : ajit.kpc@gmail.com; akg@iitk.ac.in

S.C. Sati
Aerial Delivery Research and Development
Establishment (ADRDE)
DRDO, Station Road
Agra-282 001, India
Email : scsati@rediffmail.com

Abstract

This paper presents response studies for a tethered aerostat balloon subjected to initial disturbances. The linearized small perturbations equations of motion have been decoupled into longitudinal and lateral-directional movements. First of all, trim conditions are estimated for a typical operating wind speed and then equations of motion are converted to state-space form. Eigenvalues and eigenvectors are then evaluated for the characteristic matrix. The differential equations are then solved using eigenvalues and eigenvectors approach. The initial disturbances are then applied first in isolation and then in combination. The results are presented for a reference aerostat balloon in the form of plots of responses of longitudinal and lateral motion variables with time. The plots reveal useful information which may be used for finalization of operating parameters for aerostat balloon to generate required response characteristics.