Indian Institute of Technology, Kanpur

Department of Aerospace Engineering

Quotation: Tools for Non Linear Modeling, Simulation & Data Analysis of 2000 cum Aerostat

Sealed quotation are invited by post/courier for the following item along with your complete terms and conditions. Your quote must reach this office by 31st October, 2012.

Enquiry No: IITK/AE/AKG/12-13/04

Opening Date: 19.10.12

Closing date: 31.10.2012

Tools for Non Linear Modeling, Simulation & Data Analysis of 2000 cum Aerostat

Aerostats are highly sensitive to the prevailing wind conditions. It is therefore of paramount importance to evaluate its dynamic responses to prevailing wind condition of various intensities and frequencies. The theoretical modeling and experimental validation of natural frequencies, acceleration and orientation of the Aerostat under various prevailing wind conditions is highly desirable. In order to do so IIT Kanpur is conducting flight trails of medium size aerostat details of which are mentioned below. Therefore tools are required to do theoretical modeling and analytical study of the data received from such trials as per the scope of work. These tools will be capable of not only calculating the geometric model of the aerostat but should also be able to estimate the dynamic parameters based on the geometry. They should also be capable of calculation of the parameters using the trial data of the aerostat in the given range of parameters. The results obtained should be in the form of parameter analysis and trend study for the dynamic factors.

Specification of the Aerostat:

a) Volume ~ 2000m3
b) Length ~ 33m
c) Max Diameter ~ 11m
d) Shape Profile – GNVR
e) Payload Capacity ~ 300Kg at 1KM mean sea level

Following tools are required for the theoretical modeling and analysis of Aerostat dynamics:

A tool capable of analytically calculating the geomteric and mass characterstics/parameters (eg moment of inertia, location of center of gravity, center of buoyancy, etc) of the aerostat along with the capability to calculate the tether shape/profile based on the minimal input like the profile equation, altitude, baloon temperature/pressure, wind profile, etc.

i. Aerostat Dynamic analysis package capable of nonlinear dynamic analysis of any aerostat using the the analytical methods. The dynamic analysis tool will also include the response of system to various wind disturbances and other atmospheric variations in the design of the aerostat. Mode response analysis of the aerostat for the different gust frequencies capabity should also be present.
ii. Cutomized dynamic tool capable of handling experimental data from the trial of the aerostat and also updation of the dynamic model based on the flight data. This tool will be able to calculate the time response in any different set of atmospheric conditions/disturbances, modal analysis, effect of balloon temperature/pressure on the inertia and dynamics of the aerostat, the effect of wind on the tether profile and resultant force on the aerostat, blowby, damping factors, etc. This tool will also capable to taking into account the impact of various jerks due to winch on the tether and the resulting tether oscillations.
iii. A tool is required capable of conducting multi-dimensional sensitivity analysis of the aerostat by variation of one or more parameters simultaneously for instance - Variation of various parameters like tether tension/length, inflation ratio, location of point of confluence, baloon parameters, payload location

Deliverables

These packages/tools should be provided in form of software files to IIT Kanpur which are compatile in windows environment. One year maintainence and updation charges (if any) must be included with the package. Onsite support for the same should be provided at least for the period of one year from the time of delivery. Support for the same should be provided at least for the period of 3 years from the purchase date.

Inputs provided by IIT Kanpur for customization of the computation tools

i) Time dependent data of following sensors will be provided:
   a. Inertial Measurement Unit (IMU)
   b. Load cell(s)/any other sensor to measure tether tension
   c. Balloon Pressure
   d. Balloon/gas Temperature
   e. Gush speed/velocity profile
   f. Angle of attack (alpha & Beta)
   g. Altitude
   h. Corresponding Inflation ratio(s)

ii) Location of sensors

iii) Point of confluence details

iv) Corresponding tether length(s)

v) Other geometric/mass properties like mass, location of CG, moment of inertias, shape & size of the fins, etc or equivalent data to estimate the same

Schedule

The lead time for the standard package will be maximum of 6 months. For the customized tool maximum of 12 months from the date of receipt/acceptance of data by the vendor will be provided.

The quotation should be sent at the address given below:

Dr. A. K. Ghosh

Professor

Department of Aerospace Engineering

IIT Kanpur-208016

Thanking you

(Dr. A. K. Ghosh)

Professor