Book Review

Air Dynamics, Hydro Elasticity and Flight Stability of Parachute Systems

Aviatics of Soft Flying Aircrafts
Book Author: Yu. Davydov
"Scientific – Research Institute of Parachute Constructions" Publishing House, Moscow
2006, 364 p., (in Russian and English (with Summary and part of the material of the book in English)), with a Compact Disc with video information

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In the book a number of parachute engineering problems are analyzed. Several different types of parachutes are described. Constructions of contemporary parachutes are presented and investigated. Flight of cosmic parachutes of various types is analyzed.

Numerical results in this research book are obtained by using the method of large particles. This method was proposed by the author of the book and was developed by him during the time period of about forty five years. New effects in mechanics were discovered using this method. The problems of hypersonic, supersonic, transonic and subsonic air dynamics as well as of hydro elasticity, heating, stability of flight and many others are solved by this method. Flow structures around permeable objects are investigated in this book as well. Full system of kinematical and dynamic boundary conditions at the surface of permeable body is described and extensively used in the analysis.

Stability of parachute flight is investigated in detail. Parachutes oscillate in a complicated manner while descending. They often descend at a certain nonzero balancing angle of attack. Stability of a parachute is its ability to return to an equilibrium position after a disturbance. In some investigations the smallness of the balancing angle of deviation attained (angle of attack) and the smallness of the amplitude of oscillations around the balancing angle is required. It is assumed that the parachute deviated at an assigned angle and was introduced at an initial time moment into a gas flow moving with a prescribed velocity. The change in time of the inclination angle of the parachute axis is investigated. Oscillation dynamics of a parachute for various types of problems is obtained, strange attractors in the phase plane are determined. Stable and unstable oscillation processes result and they are analyzed. It is shown that the phase trajectories apart from the limit cycles can include loops and wavy singularities. Measures for improvement of parachute design with the purpose of stabilizing insufficiently stable parachutes are presented. It is obtained that with increasing altitudes oscillations of the parachute become less intense, although maximum oscillation amplitudes remain approximately the same.

This book is recommended for research workers and mechanical engineers in the fields of plane, rocket and parachute construction, especially for those who are interested in the theory and calculations of dynamics and stability of parachutes.