

DEPARTMENT OF MECHANICAL ENGINEERING

SEMINAR SERIES



The Effect of Shock Waves Movement on Flutter and Self-Oscillations of an Elastic Aircraft in Transonic Flow

Dr. Michail Zichenkov
Deputy General Director of TsAGI
The Central Aerohydrodynamic Institute (TsAGI)
Moscow Region, Russia

The Central Aerohydrodynamic Institute (**TsAGI**), named after Professor N.E. Zhukovsky, is the leading Russian aeronautics research organization founded in 1918. This seminar will present an overview of the research project done in collaboration with the NRC. The main purpose of this project is the investigation of the effect of changes in the location of a shock wave on flutter and limit cycle oscillations of an aerodynamic surface of an elastic aircraft in transonic flow. The creation of the methodology for researching flutter boundaries of an airplane and parameters limit cycle oscillation is proposed.

In this project, the methods, algorithms and software of new aeroelasticity aspects have been developed to include transonic oscillation, connected with motions of shock waves on lifting surfaces. Numerical integration of the Euler equations was carried out both for ideal gas and taking into account of a flow viscosity. The theoretical research of strength and aeroelasticity of the considered structures of a baseline passenger regional airplane was performed. The development of a methodology includes the following elements of research:

- forming of mathematical models of motion of an elastic airplane with control surfaces in transonic flow;
- calculation of flutter boundaries of an airplane considered as a linear system;
- creation of a computational model for flutter taking into account nonlinearity caused by motion of shock waves on the lifting surface in transonic flow;
- development of a computational method for determination of characteristics of flutter and limit cycle oscillations in the frequency domain;
- creation of an algorithm for computation of unsteady aerodynamic coefficients using nonlinear Euler equations taking into account the viscosity of a flow;
- research of non-linear transonic flutter in the time domain by the method of numerical integration.

DATE: Thursday, May 23, 2013
TIME: 1:30 - 3:00pm
LOCATION: Macdonald Engineering Bldg, RM 267



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ABOUT THE SPEAKER and TsAGI

Dr. Mikhail Zichenkov was born in Moscow. He has worked at the Central Aerohydrodynamic Institute (TsAGI) since 1979, after graduating from the Moscow Physics-Technical Institute. He is a specialist on strength and aeroelasticity for aviation, Ph. Dr. engineering.

Dr. Zichenkov held various positions at TsAGI and he became Deputy General Director and Head of the Structure Strength Complex in 2010.

TsAGI is one of the biggest research centers in the world. It was the first scientific institution to combine basic studies, applied research, structural design, pilot production and testing. TsAGI has developed new aerodynamic configurations, aircraft stability/controllability criteria, and strength requirements. TsAGI was a pioneer in the theory of flutter along with many other theories, applications and experimental studies.

During the last two decades TsAGI has achieved significant advances in Aerodynamics, Flight dynamics and Flight control systems, as well as improving static material strength, service life and reliability of civil airplanes.

All Soviet aircrafts ever flown have been created in accordance with TsAGI recommendations and with continuous use of its testing facilities.

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