SEMINAR - סמינר

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 29.01.2018 (י"ג בשבט, תשע"ח), בבניין דן קאהן, אודיטוריום 1, 14:30.

מרצה:

Professor Vasily Vedeneev
Faculty of Mechanics and Mathematics
Lomonosov Moscow State University

על הנושא:

Development of nonlinear oscillations in a single mode panel flutter

The seminar will be given in English

להלן תקציר ההרצאה:

The loss of stability and intensive vibrations of aircraft skin panels caused by aeroelastic interaction with the air flow is a well known phenomenon in aviation called "panel flutter". There exist two types of panel flutter: a coupled-mode and a single-mode flutter. A coupled-mode flutter was studied in detail in the 1950-1970th in linear and nonlinear formulations; it leads to the occurrence of a single stable limit cycle. Single-mode flutter was investigated in a linear formulation only a few years ago. Its nonlinear development turns out to be much more interesting than the development of coupled-mode flutter. The study consists of two parts, analytical and numerical. In the first part, the Bubnov-Galerkin and harmonic balance methods are used to obtain a system of equations for the amplitudes, which describes the limiting cycles. The solutions of this system are investigated analytically. It is shown that with a small penetration into the flutter region, a single stable limit cycle exists. With further deepening, there appears an internal fractional resonance between the growing and damped modes, leading to the birth of a resonance limit cycle. Further, other non-resonant and resonant limit cycles appear, in which several modes participate. A possibility of co-existence of stable limit cycles, resonant and non-resonant that involve oscillations in the same modes, is proved. The second part of the talk is devoted to the study of nonlinear oscillations using direct numerical simulation. The calculation is conducted in FlowVision (air flow simulations) and Abaqus (plate motion simulation). We study the development of a small perturbation of a plate introduced at t=0 up to the formation of limit cycle oscillations. The amplitudes of the oscillations are found, and it is shown that the amplitude growth when deepening into the flutter region occurs much faster for a single-mode than for a coupled-mode flutter. A region of Mach numbers (quite remote from the stability boundary) is found, where there is a transition from the limit cycle to non-periodic oscillations. With a further increase in the Mach number, a return to periodic oscillations, and then to a stable state occurs. At much higher Mach numbers, a flutter appears again, but of a coupled-mode type. Correlation between analytical and numerical results is discussed.

המארח: פרופ' עודד גוטליב

בברכה,

פרופ"א מתי סאס

מרכז הסמינרים