Technion-Israel Institute of Technology
Faculty of Mechanical Engineering

הטכניון-מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ד' 10.04.2019

(ה' בניסן תשע"ט), בניין דן קאהן, חדר 217, 13:30.

מרצה: עמית דולב

מנחה: פרופ' יצחק בוכר

על הנושא:

מנגנונים מבוססי עירור פרמטרי לגילוי, זיהוי ושפעול סלקטיבי במערכות מפולגות

Parametrically excited mechanisms for selective detection, identification and actuation in distributed systems

The seminar will be given in Hebrew

תקציר ההרצאה :

Oscillatory response in distributed mechanical systems is of great interest, and can be utilized for various applications, such as detection, identification and actuation. Oscillations can be generated efficiently by parametric excitation (PE), which is achieved by a periodic change in the system's energy storing parameters (i.e., inertia or stiffness). In this work, the PE was realized by periodically modulating the stiffness. The investigation of the various systems comprises three fundamental stages: (a) analytical model, (b) numerical verification of (a), and (c) experimental validation of (a) and (b) leading to refinement of the model.

The first part of the talk deals with standing wave acoustic levitation, and utilization of PE as a mean to manipulate levitated objects' position. The dynamics of acoustically levitated rigid small spheres subjected to PE was studied. Therefore, a single-axis ultrasonic (~28.5 kHz) levitator, was designed and built, and the generated complex acoustic field was estimated by the boundary elements method. Employing Gor'kov's theory, the nonlinear acoustic radiation forces counteracting gravity were approximated. To introduce PE experimentally, the emitter's vibration spectrum was modulated by integrating a phase-locked loop and signal processing realized in real-time via a fast, digital signal processor (FPGA). Realization of principal parametric resonance allows to: 1) Oscillate a specific particle, 2) Oscillate a particle in a chosen direction in space, 3) Eject a particle from an acoustic trap.

The second part of the talk deals with a novel dual frequency parametric amplifier, which is parametrically excited with two frequencies, and externally forced. The external forcing is the input signal to the amplifier, which should be amplified for identification purpose. By employing dual frequency PE, the system experiences principal parametric and combination resonances. The latter resonance blends the input signal's frequency with the system's natural frequency, and the former resonance amplifies the response at the natural frequency. In distributed systems, utilization of this scheme allows to project external forces onto any selected vibration mode of the system, and amplify its influence. Therefore, this method was extended to the rotor-dynamics field, and was used to develop a novel method for mass balancing procedure. The method is unique, because rotors with this approach are span far below the critical speeds, and still the effect on high frequency vibration modes can be identified.

בברכה,

פרופ"מ מתי סאסו

מרכז הסמינרים