סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ה' 11.11.21 (ז' בכסלו, תשפ"ב), בשעה 13:00 באמצעות הזום : https://technion.zoom.us/j/91787092310
ובאוד' 1 , קומה 0, בניין דן קהאן.

מרצה : מג'די גזאל

מנחה : פרופ' אולג גנדלמן

על הנושא:

Nonlinear Phenomena in Engineering Systems

The seminar will be given in English

תקציר ההרצאה :

The presence of nonlinearity in a dynamic engineering system is historically viewed as undesirable and the emphasis has been to design systems ensuring that nonlinear behaviour regimes are avoided. However, the desire for more efficient engineering systems' performance has led to pushing existing design solutions beyond their linear limit, and it becomes more common for structures to behave nonlinearly. This seminar will touch topics on constructive utilization of intentional strong nonlinearity to improve engineering systems' performance envelope and meet their response specifications in a broader manner.

In the first part of the talk, we revisit the nonlinear dynamics of elliptical cross-section valve spring of an internal combustion engine. The investigation includes: (i) development of novel analytical expression for determining the stress distribution in the cross-section, and (ii) mathematically modeling the spring nonlinear dynamics as a finite non-homogenous one-dimensional mass-spring-damper discrete chain. Exact solutions in the form of time-periodic and spatially localized edge states are derived. The stability of the system is analyzed using the Floquet theory. The investigation of this system comprises three fundamental stages: (a) analytical treatment, (b) numerical verification, and (c) experimental validation conducted on an actual valve spring leading to refinement of the model.

The second part of the talk focuses on the passive mitigation of dynamical responses of engineering structures subjected to extreme loads (i.e., high-energy, often short-duration transient excitations such as blast, seismic, shock) occasionally being the result of accidents, natural events, or intentional human actions. One of the most important issues here is rather limited suppression achieved for the first few (but most intensive and dangerous) cycles of the structural response to the excitation. To address this challenging problem, we propose a rapid and efficient nonlinear non-resonance mechanism for low-to high-frequency energy scattering through strong local nonlinearities, which we refer to as *intermodal targeted energy transfer* (IMTET). The IMTET mechanism will be demonstrated in the fields of blast and seismic mitigation by means of benchmark engineering systems including: 2DOFs linear system with a single impact clearance, model of a nine-story steel structure with a rigid/flexible core structure, and model of twenty-story steel structure with a flexible core structure. The main benefits in implementation of the IMTET in such systems are presented, and their respective performances are discussed.

בברכה,

פרופ"ח אתי סאס

מרכז הסמינרים