MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Thursday, July 31 2025 at 13:30-14:00, **Lady Davis Bldg., Room 250**

Dynamic response structural optimization based on a first-order equivalent static loads algorithm

Mordechay Buzaglo

Adviser: Assist. Prof. Nicolò Pollini

Structural optimization is a core component in modern engineering, which enables engineers to obtain more efficient design solutions. For many applications, the real-life dynamic loading on the structures must be taken into account, even though it often requires considerable computational resources. The Equivalent Static Loads (ESL) approach was developed in an effort to reduce structural optimization problems' complexity. It simplifies dynamic response optimization problems by transforming them into series of static sub-problems. Although the basic ESL is widely used and conceptually simple, it does not include design-dependent information in the definition of the equivalent static loads, and therefore cannot, in general, intentionally drive the optimization algorithm towards optimal final solutions of the original problem. To bridge this gap, a novel formulation called the First-order Equivalent Static Loads (F-ESL) is presented. F-ESL enhances the original ESL formulation by incorporating variable dependent first-order information into the equivalent static loads definition. This ensures that the resulting F-ESL algorithm is able to recognize final solutions that satisfy first-order optimality conditions. The proposed approach is assessed using a set of reproducible numerical examples with increasing complexity. F-ESL consistently demonstrates better performance compared to ESL. We observe that in the numerical applications considered F-ESL requires overall fewer transient analyses than those required by solving the original dynamic response optimization problem directly. At the same time, F-ESL preserves the simplicity that characterizes the basic ESL algorithm. F-ESL thus offers a practical and effective approach for dynamic response structural optimization, particularly in applications where the computationally-expensive original problem can be approximated, as for example is the case in the early conceptual design phases.

Note: the seminar will be given in English

Seminars Coordinator: Assoc. Prof. Shmuel Gal.