

הנדך מוזמנת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתקיים ביום ב' 16.04.2018 (א' באייר, תשע"ח), בניין דן קאהן, אודיטוריום 1, 14:30.

**מרצה:** דן משה קלנר

**מנחה:** פרופ' יזהר אור

**על הנושא:**

## **Analysis of the hybrid dynamics of a planar rigid body with two frictional contacts near an equilibrium state**

The seminar will be given in Hebrew

**תקציר ההרצאה:**

Dynamical systems with unilateral frictional contacts are very common in the field of robotics in applications such as grasping and assembly in automated manufacturing lines, as well as in locomotion of legged robots. These kinds of systems must possess dynamic stability under external perturbations. Nevertheless, these systems are complex to model and analyze. Such systems are characterized by varying contact states including separation, stick-slip transitions which depend on the body's dynamics, and impacts due to collisions at contacts. A major problem in such systems is the analysis of the dynamic response in a small neighborhood of a static equilibrium configuration under small perturbations in position and velocity. Only few studies were carried out in order to analyze the dynamical behavior of such systems. In particular, the recent work done by Varkonyi and Or [2016] used a few simplifications and assumptions in order to develop a semi-analytic method for determination of stability of equilibrium configurations for a planar rigid body with two unilateral frictional contacts subjected to external force and inelastic impacts.

In the current work, a full nonlinear formulation and numerical analysis of the system is presented. The full nonlinear dynamic equations under each possible contact state are formulated explicitly, as well as the impact law assuming inelastic collisions. Transitions graphs are plotted in order to demonstrate the possible transitions between contact modes and the conditions to stay in each contact mode or to move between them. Furthermore, a brief review of the "Zero Order Dynamics" (ZOD) simplification and a few assumptions which were used in Varkonyi and Or [2016] to develop the semi-analytic stability analysis are presented here.

It is found that the ZOD simplification and the other assumptions have a very small (and impractical) region of validity. Nevertheless, for such small perturbations the responses calculated using the simplified and nonlinear methods are almost identical.

בברכה,

ד"ר משה קלנר  
מרכז הסמינרים