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׳ 28.02.2018 (יג׳ באדר, תשע״ח), בניין דן קאהן, אודיטוריום 1, 13:30.

מרצה: ירון גלבוע

מנחה: פרופ׳/ח מרים זקסנהויז

על הנושא:

Optimization of Control Laws of Dynamic Walking Robots through Region of Attraction

The seminar will be given in Hebrew

להלן תקציר ההרצאה:

The increase in demand for efficient and robust walking robots has been a major cause for the development of new robots and controller designs. Among them is the dynamic walker, which exploits the natural properties of its dynamics to walk using relatively small amount of energy. However, developing methods to designing such controllers, and more so estimating their capabilities, is still an open problem. A common approach to walking dynamic robots is through limit cycle walking, which views the gait of the robot as a stable limit cycle, and by discretization of the gait, known as the Poincaré map, one can study the orbital stability of the limit cycle. Local stability can be assessed by examining the eigenvalues of the linearized Poincaré map. However, when introduced to larger disturbances which are common in walking robots, local stability is insufficient for determining the robustness of the gait. Therefore, it can be important to examine the Region of Attraction (RoA), which is the set of all initial conditions on the discretization map from which the system converges to the limit cycle. However, it is rather difficult to consider the RoA as a tool while designing the control law of the system because of its complexity and the time required for its computation.

The work presented in this seminar proposes a method of designing a control law based on an existing limit cycle controller (base controller) and its RoA. By implementing a compensation controller to the base controller, which uses samples taken on a once-per-cycle basis, while taking consideration of the base controller's RoA, it is possible to create a compensated system which exhibits a larger RoA with improved disturbance rejection, without altering the properties of the limit cycle. This method is further examined by demonstrating the application on a compass biped robot (CB), as well as variations for dealing with slopes. We review the performance of the compensated system in comparison to the base controller, testing the systems with disturbances and checking the performance across a stochastic terrain.

בברכה,

פרופ״מ מתי סאס

מרכז הסמינרים