Date: Monday, January 26, 2026

Time: 10:10-11:00

Location: Nano Building 51, seminar room 015

Speaker: Prof. Nir Shvalb, Chairman, Dept of Industrial Engineering & Management, Ariel University

Title: Hypo-paradoxical Linkages: Linkages That Should Move But Don't

Abstract: We shall introduce a new class of mechanical systems called hypo-paradoxical linkages—mechanisms that appear mobile according to the Chebyshev–Grübler–Kutzbach mobility criterion yet are in fact completely rigid. Building on the historical context of paradoxical linkages such as the Bennett and Bricard mechanisms, the lecture presents the geometric and algebraic foundations of these “inverse paradoxes.” Using screw theory and hyperboloid geometry, it is shown that certain symmetric configurations—such as regular n-gon spatial chains—become kinematically locked when their revolute axes intersect a common line in an ordered fashion. The concept of an immobility margin is introduced to quantify how close a design is to such a locked configuration, supported by simulation and 3D-printed models. Finally, we shall reinterpret the Bennett linkage through the same geometric lens, revealing why it moves while its hypo-paradoxical analogues do not.

Bio: My main field of research is robotics. Among other things, I deal with theoretical robotics, medical robotics, micro-robotics, global motion planning and one based on three-dimensional sensing systems. My theoretical research is based on algebraic topology – I explore the spatial configurations of graphs under different geometric constraints. I am involved in three main fields of research: Practical Robotics; General Robotics research and Applications of algebraic topology for robotics research. I founded ‘Momentis sugical LTD.’ company. The robot is the first of its kind for gynecological NOTES and as of 2020 it is FDA approved. I also founded ‘Innoging LTD.’ which provides a system that will enable repeated analysis of radiologists and ‘W endoluminal robotics’ which provide a novel endoscopic tool. Some of my research efforts are dedicated to hyper-redundant robots, flexible robots, Navigation Functions for uncertainty conditions, Pedestrians motion prediction, traffic supervision in the age of autonomous cars, multi-agents with multiple targets etc.