הטכניון – מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

TECHNION – Israel Institute of Technology
Faculty of Mechanical Engineering

SEMINAR - סמינר

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ה' 22.12.16 (כב' בכסלו, תשע"ז), בבניין ליידי דייויס, אודיטוריום 250, 12:30.

<u>ירצה</u>:

Prof. A.L. Yarin
University of Illinois at Chicago

<u>על הנושא</u>:

MECHANO-RESPONSIVE NANO-TEXTURED HYDROGELS

<u>להלן תקציר ההרצאה</u>:

Several recent inter-related topics which stem from the applications of stimuli-responsive polymers in such fields as active microfluidics, micro-actuators and development of drug carriers are discussed. A special emphasis has been put on poly(N-isopropylacrylamide) (PNIPAM) and the related water-insoluble copolymers and nanofibrous membranes formed from them. The ease of their tunability and "smart" behavior triggered by changes in temperature and pH are in focus.
A significant part of the talk is devoted to the theory of two-dimensional Poly(N-isopropyl acrylamide)-Thermoplastic Polyurethane (PNIPAM-TPU) bilayers and of three-dimensional PNIPAM-TPU bilayer filaments. This is the first theory which provides a comprehensive explanation and a detailed description of buckling of PNIPAM-TPU bilayers. In agreement with the experimental evidence it reveals that being immersed in a water bath at temperature T<LCST (the lower critical solution temperature), water infiltration into the porous PNIPAM layer of the bilayer begins resulting in swelling and stretching. Being inevitably perturbed (not perfectly straight) at the beginning, a long thin bilayer begins to buckle. However, its buckling is not identical to that of the elastic Euler bars, since the PNIPAM layer in the bilayer is loaded by a distributed compressive force imposed by the bonded TPU layer, while the Euler bars are loaded by compressive forces only at the ends. It is shown that when buckling bilayer stays in the cold bath at T<LCST for a long enough time, its stretching practically stops. However, its buckling continues for a while, since the longitudinal compressive force acting on the PNIPAM layer from the bonded TPU layer permanently exists. That results in self-coiling of the bilayer, which continues until a steady-state coiled configuration is achieved. It is shown that the steady-state coil radius is of the order of the bilayer thickness, much less than the original bilayer length, because the bilayer buckling is driven by a longitudinally distributed compressive force rather than by the compressive force applied only at the ends (like in the classical Euler buckling when the final radius of curvature is of the order of the bar length). If alternatively, after some period of swelling, stretching and buckling, water in the bath is replaced by hot water at T>LCST, water outflow from the PNIPAM-TPU bilayer begins and it shrinks to its original short length and a practically straight initial configuration. When a PNIPAM-TPU bilayer is immersed directly in a water bath at T>LCST, the PNIPAM layer begins to shrink, thus compressing the TPU layer, which in turn, triggers buckling. Long PNIPAM-TPU bilayer filaments, being submerged in water bath at T<LCST, buckle as a circular helix with its radius of curvature and pitch decreasing in time.

בברכה,

<u>המארח</u>: פרופ' איל זוסמן

פרופ"א שאול אופנסקי
מרכז הסמינרים