הטכניון – מכון טכנולוגי לישראל **הפקולטה להנדסת מכונות**

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב׳ 12.10.15 (כט׳ בתשרי, תשע״ו), בבניין דן-קאהן, קומה 0, באודיטוריום 1 בשעה 14:30.

ירצה: אורי ליאל

מנחה: פרופ׳/מ גלעד יוסיפון

על הנושא:

Overlimiting Current in Microchannel-Nanochannel Fluidic Devices

להלן תקציר ההרצאה:

Nanofluidics is an emerging field of interest because of its potential to study and manipulate fluids, nanoparticles, ions and molecules in lab-on-a-chip devices consisting of channels having at least one dimension of nano-scale. Nanofluidics is not just a scaled-down version of microfluidics, but has fundamental differences with new forces at play. In particular, this is due to the electric Debye layer (EDL), a charged layer (~10-100 nm) that forms in a liquid adjacent to a solid wall. When the cross section dimensions of the nanochannel/nanopore approach the length scale of the EDL, overlap of EDLs from opposite walls occurs and results in the nanochannel ion permselectivity, i.e. favoring transport of ions of a particular sign.

Similarly to membranes, upon application of an electric field the permselectivity of the nanochannel leads to concentration enrichment and depletion on its opposite sides, termed concentration polarization. Upon further increase of voltage, when the ionic concentration on the anodic side of the nanochannel/membrane approaches zero, an extended space charge (ESC) layer appears to support over-limiting current, i.e. current beyond the classical diffusion limit.

Despite two centuries of research, our understanding of ion transport and electro-osmotic flow in and near nanochannels/membranes, in particular at over-limiting current conditions, remains woefully inadequate. We present results demonstrating the ESC-mediated transition between classical, diffusion-limited current and over-limiting current in micro-nanochannel devices. The ESC is correlated with a distinctive maximum in the dc resistance. Experimental results for a shallow surface-conduction dominated system are compared with theoretical models, allowing estimates of the effective surface charge at high voltage to be obtained. Further, we extend the study to microchannels of moderate to large depths where the role of various electro-convection mechanisms such as electro-osmosis of the second kind and electro-osmotic instability becomes dominant.

בברכה,

פרופ׳/מ אמיר גת
מרכז הסמינרים