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

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ה׳ 5.01.17 (ז׳ בטבת, תשע״ז), בניין דן-קאהן, קומה 0, אודיטוריום 1 , 14:30.

ירצה: יובל הרדוף

מנחה: פרופ״מ יזהר אור

על הנושא:

אנליזה של מעברי יציבות במיקרו-שחיין בעל ראש סופר-פאראמגנטי

Analysis of stability transitions in a microswimmer with superparamagnetic head

The seminar will be given in Hebrew

להלן תקציר ההרצאה:

Robotic microswimmers are a source of growing interest in the fields of physics and biomedical robotics. The famous work of Dreyfus et al (2005) introduced a robotic microswimmer composed of a chain of superparamagnetic beads and actuated by a planar oscillating magnetic field. Further experiments and numerical simulations of the swimmer model revealed that for large enough oscillation amplitude of the magnetic field's direction, the swimmer's mean orientation and net swimming direction both flip from the mean direction of the magnetic field to a direction perpendicular to it.

In the current work, this phenomenon is analyzed theoretically by studying the simplest possible microswimmer model: two slender, rigid links connected by an elastic joint, while one link is superparamagnetic. The dynamic equations of motion are formulated explicitly, and various asymptotical analyses are carried out, leading to analytical conditions for stability transitions and explicit expressions of the swimmer's mean speed, both confirmed via numerical analysis of the model. It is found that there exist intermediate parameter regions of dynamic bi-stability where the solutions of swimming about the aligned and perpendicular directions are both stable under different initial conditions.

Since the system can be simplified as a 2^{nd} order ODE with parametric excitation, the stability transitions are reminiscent of those exhibited by Kapitza's pendulum, a pendulum with an oscillating pivot. Finally, preliminary experimental results of our research collaboration with Li Zhang from Chinese U. Hong Kong are presented, corroborating our theoretical predictions.

בברכה,

פרופ״מ שמואל אוסובסקי

מרכז הסמינרים