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 ב' 20.04.15 (א' באייר, תשע"ה), בבניין דן-קאהן, קומה 0, אודיטוריום 1, שעה 14:30.

יצרה:

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על הנושא:

Theoretical and experimental analyses of AFM array dynamics

להלן תקציר ההרצאה:

Advanced atomic force microscopy (AFM) technology includes the development of cantilever probe arrays for faster scan rates. Current commercial AFM technology bases the control scheme of a single cantilever concept on optically measuring the tip deflection directly. In the array concept, however, where multiple cantilevers are operated in parallel, the deflection of each cantilever is indirectly measured at the fixed end, so that the control scheme is able to operate each resonator individually. This work is considering the PRONANO array technology (Rangelow Group at TU Ilmenau), in which the cantilevers of the array are thermally actuated individually and the deflection of the tip of the cantilever is measured by a piezoresistive bridge positioned at the fixed end of the cantilever. This indirect measurement of the tip displacement requires accurate models of the individual cantilever as well as the interaction characteristics between the tip and sample surface. We investigate and discuss the nonlinear dynamic behaviour of a 5-member array in the presence of varying interactive forces at the tip while measuring corresponding strains at the fixed end. Our investigations consider micro- and macro-scale experiments and a multi-physics model. The coupled, nonlinear, dynamic model is based on a modified Euler-Bernoulli beam model for a composite structure, Fourier heat conduction and the thermo-elastic constitutive law. The equivalent macro-scale experiment replaces the micro-scale interaction forces (evident in AFM operation) by an electromagnet in conjunction with either a soft plastic sample or a nonlinear spring between tip and sample surface. The analysis visualises typical phenomena as observed experimentally, including non-linear tip deflection, jump-to-contact, attractive and repulsive operation domains. Results show that the validated mathematical model together with the indirect measurements at the fixed end of the cantilever predict the tip displacements qualitatively and quantitatively.

המארח : פרופ' עודד גוטליב

בברכה,

פרופ' אמיר שמ
מרכז הסמינרים