הטכניון
מכון טכנולוגי
לישראל

TECHNION
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Faculty of Mechanical Engineering | הפקולטה להנדסת מכונות

Israel Pollak
Distinguished Lecture Series

The Faculty of Mechanical Engineering
cordially invites you to a series of lectures
to be presented by

סדרת הרצאות אורח
ע"ש ישראל פולק

הפקולטה להנדסת מכונות
מתכבדת להזמינך לסדרת הרצאות
שתינתן על-ידי

Professor Guruswami (Ravi) Ravichandran

Division of Engineering and Applied Science
California Institute of Technology

Main Lecture — הרצאה ראשית

Mechanics of Cell-Matrix Interactions in Three-Dimensions

Monday, May 16, 2022, at 2:30 p.m
Auditorium 6, Entrance Floor
D. Dan & Betty Kahn Bldg.
Faculty of Mechanical Engineering

יום שני, 16 במאי 2022, בשעה 14:30
באודיטוריום 6, קומת הכניסה
בבניין ד. דן ובטי קאהן
בפקולטה להנדסת מכונות

Informal Lecture — הרצאה נוספת

Quantitative Visualization in Mechanics: Challenges and Opportunities

Sunday, May 15, 2022, at 2:00 p.m
Auditorium 1, Entrance Floor
D. Dan & Betty Kahn Bldg.
Faculty of Mechanical Engineering

יום ראשון, 15 במאי 2022, בשעה 14:00
באודיטוריום 1, קומת הכניסה
בבניין ד. דן ובטי קאהן
בפקולטה להנדסת מכונות

Refreshments will be served prior to the main lecture

כיבוד קל יוגש לפני ההרצאה הראשית

MECHANICAL ENGINEERING SEMINAR

In the cadre of the Israel Pollak Distinguished Lecture Series

Sunday, May 16 2022 at 14:30, D. Dan and Betty Kahn Building, Aud. 1

Mechanics of Cell-Matrix Interactions in Three-Dimensions

Professor Guruswami (Ravi) Ravichandran
Graduate Aerospace Laboratories
California Institute of Technology
Website: https://eas.caltech.edu/people/ravichan

Hosted by: Prof. Daniel Rittel

Biological cells can be viewed as micromachines, which are complex living systems deriving many of their mechanical functions from the molecular motors within the cell. The forces applied by the cells to their surrounding extracellular matrix through focal adhesions influence processes such as growth, adhesion, development, and migration. A new experimental approach is presented for quantifying three-dimensional full-field displacements and tractions exerted by cells embedded in a fibrous matrix. Cells and their surrounding matrix are imaged using laser scanning confocal microscopy, and the displacements in the matrix are computed using digital volume correlation. The three-dimensional traction force microscopy technique is used to investigate how cells employ physical forces during cell division, spreading, and sensing. During division, cells apply a tensile force to the matrix through thin persistent extensions, which direct the orientation and location of the daughter cells. During spreading, cells extend thin protrusions into the matrix and apply forces using these protrusions. These forces lead to the formation of localized intercellular bands of tensile deformations. A constitutive model for a fibrous material to simulate deformations induced by cells is discussed. The model captures measured cell-induced matrix displacements from experiments and identifies loss of compression stiffness due to micro buckling of fibers as an essential mechanism for long-range mechanosensing between cells.

Biography

Guruswami (Ravi) Ravichandran is the John E. Goode, Jr. Professor of Aerospace and Mechanical Engineering at the California Institute of Technology. He received his B.E. (Honors) in Mechanical Engineering from the University of Madras, Sc.M. in Engineering and Applied Mathematics and Ph.D. in Engineering (Solid Mechanics and Structures) from Brown University. He is an elected member of the U.S. National Academy of Engineering, Academia Europaea, and European Academy of Sciences and Arts. He is a Fellow of the American Society of Mechanical Engineers (ASME), Society for Experimental Mechanics (SEM) and American Academy of Mechanics (AAM). He was named Chevalier de l'ordre des Palmes Academiques by the Republic of France.

His awards include A.C. Eringen Medal from the Society of Engineering Science, Warner T. Koiter Medal from ASME, and William M. Murray Lecture Award from SEM. His research interests are in mechanics of materials including micro/nano mechanics, wave propagation, composites, active materials, biomaterials and cell mechanics, and experimental methods.

Seminars Coordinator: Assoc. Prof. Matthew Suss.