UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

CIVE 6111 Graduate Seminar Series

Professor Bernhard A. Schrefler

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Department of Nanomedicine
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The Role of the Extracellular Matrix in Tumor Growth Modeling

Wednesday, February 11, 2015

11:00 - 12:00 am Seminar Room: D3-E323

Abstract

Multiphase porous media mechanics is applied to model tumor growth. The multiphase system consists of four phases: the extracellular matrix (ECM), the tumor cells (TC), which may include a necrotic portion depending on the environmental conditions and pressure; the healthy cells (HC); and the interstitial fluid (IF) with the dissolved chemical species. The three phases, HC, TC and IF are modeled as fluids while the ECM is an elasto-visco-plastic solid. The governing equations are obtained by means of the Thermodynamically Constrained Averaging Theory (TCAT) involving two scales: the microscopic scale (pore scale) and the macroscopic scale which is the scale of interest where the governing equations are solved numerically. The Finite Element Method is used for this purpose. The interaction between the constituents is investigated. Several cases of biological relevance are solved where inclusion of a solid phase, missing in most legacy growth models, is unavoidable.

About the speaker:

Bernhard A. Schrefler is Professor of Structural Mechanics at the University of Padua and Senior Affiliate Member of the Methodist Hospital Research Institute in Houston. He graduated with an honours degree in Engineering from the University of Padua in 1967, and obtained his Ph.D. and D.Sc. at the University of Wales.

He has published over 420 papers, 5 textbooks and 24 edited texts.

His research has addressed fundamental aspects of applied mechanics, large scale computation and diverse applications to problems of practical interest. The largest part of his research activity is devoted to mechanics of porous media.

In the field of bio-medical engineering he has applied porous media mechanics to the analysis of soft tissues such as periodontal ligaments, spinal disc, trabecular meshwork in the eyes and Artificial Neural Networks (ANNs) for adhesion modeling of nanoparticles in diseased microvasculature. The remaining research activity belongs to the fields of structural and materials mechanics and technology for thermonuclear controlled fusion.