



College of Engineering
Department of
Mechanical & Industrial Engineering



The Robert W. Courter Seminar Series

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PFT 1206

Network Materials: Structure-Properties Relation and Applications

by Prof. Catalin Picu

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Many materials have a stochastic network of filaments as their main structural component and are referred to collectively as 'network materials.' This class includes all biological connective tissue, the extracellular matrix, the intra-cellular cytoskeleton, paper and cellulose-based products, nonwovens, as well as various molecular networks such as rubber, gels and thermosets. Molecular networks are thermal, in the sense that thermal fluctuations affect their behavior, while all other examples provided are athermal. This talk reviews the relation between the structure of athermal networks and the material-scale mechanical properties, focusing on identifying commonalities between these very diverse material systems. Properties of interest include the non-linear elastic response, the viscoelastic response, strength and toughness. The effect of an elastic or viscoelastic matrix on network behavior will be discussed. Inter-fiber adhesion is important in some applications, and this leads to special effects which will be reviewed, if time permits. The talk provides a comprehensive overview of the mechanics of this broad class of materials.

*Prof. Picu received his PhD degree from Dartmouth College and spent two years as Research Associate at Brown University. He joined the Department of Mechanical, Aerospace and Nuclear Engineering at Rensselaer Polytechnic Institute in 1998, where he is now Professor and Associate Department Head. He is the author of a book on Network Materials, the co-author of two other books, 20 book chapters and over 200 journal articles. He is a fellow of the American Society of Mechanical Engineers (ASME) and Doctor Honoris Causa of the Polytechnic University of Bucharest, Romania.