DCAMM SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS934 12 April 2018

A DCAMM seminar No. 723 will be presented by

Professor Ramesh Talreja
Department of Aerospace Engineering
Department of Materials Science and Engineering
Texas A&M University, USA

The title of the lecture is

Transverse Cracking in Polymer Matrix Composites: A (nearly) Complete Story from Molecular Dynamics Simulation to Percolation

Abstract:

Formation of a transverse crack, i.e., a crack that forms under application of a tensile force normal to fibers, has been of interest in failure analysis and design of composite materials mainly because it is believed to be the first cracking mode leading to other failure mechanisms causing final failure. Experimental observations suggest that fiber/matrix debonding occurs first, followed by the interface cracks kinking out into the matrix and thereby linking up with other debonds. When sufficiently many debond cracks have coalesced, a continuous transverse crack is believed to form. This presentation will describe analyses at different scales, beginning with the molecular level of the epoxy matrix and ending at the representative microstructural level where the transverse crack begins growing with its own driving force (energy release rate). By means of a molecular dynamics simulation, it will be shown that brittle cavitation under hydrostatic tension in epoxies is most likely the precursor to fiber/matrix debonding. The next level analysis considers the debond crack growth and kink-out as influenced by the neighboring debond cracks. Finally, statistically simulated representative volume elements (RVEs) are analyzed to reveal the effect of manufacturing induced nonuniformilty of fiber distribution on the debond initiation and subsequent transverse crack formation. A percolation concept is then used as a short-cut to determining the applied force at formation of transverse cracks.

DATE: **Monday, 30 April 2018**

TIME: **10:00 – 11:00 incl. questions**

PLACE: **Meeting room 2+3, Building 238**
DTU Risø Campus
Frederiksborgvej 399, 4000 Roskilde

Danish pastry, coffee and tea will be served 15 minutes before the seminar starts.

All interested persons are invited.

Niels Leergaard Pedersen