SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS999 10 June 2024

A DCAMM seminar No. 777 will be presented by

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The title of the lecture is

Crack control in adhesive joints using 3D printed architected substrates

Abstract:

Current aerospace, automotive, and shipbuilding industries increasingly use lightweight materials to enhance strength and damage tolerance. The need to combine new high-performance materials and meet demanding end-use applications has provided significant momentum for using structural adhesives. In this context, there is growing research interest in the combination of adhesive bonding and additive manufacturing (AM). By integrating AM with adhesive bonding, it is possible to combine materials, or material and space, into configurations that offer enhanced performance. Additionally, breaking down large objects into smaller sub-components assembled after printing circumvents build volume limitations and facilitates the manufacturing of multi-material components.

This presentation focuses on our most recent research results in this area, which combine a cohesive zone approach, design exploration, and selective laser sintering. We highlight how controlling substrate architecture in Double Cantilever Beam adhesive joints can promote shielding and delayed crack growth, while also unlocking energy-absorbing processes, such as interfacial void growth and buckling, that are absent in the control joints. A key feature of our recent work, discussed here, is the use of a mechanoluminescent (ML) coating to reveal the evolution of the transient stress field associated to snap-through crack propagation. The coating comprises an optical epoxy resin loaded with doped strontium aluminate phosphors (SrAl2O4/Eu2+), which converts mechanical energy into light emission with an intensity proportional to the magnitude of mechanical stress. Our experimental results, combined with FE simulations, provide valuable insights into the fracture process and deepen our understanding of the mechanical behavior of adhesive joints with architected substrates.

DATE: **Monday, 24 June 2024**

TIME: **12:00 – 12:45**

PLACE: Navitas Building, Meeting room 3210-03.070,
Aarhus University,
Inge Lehmanns Gade 10, Aarhus

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

All interested persons are invited.

Jan Becker Høgsberg