LMS Seminar

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Image-based modeling of carbon-carbon and ceramic-matrix composites: from X-ray microtomographies to finite element models

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ABSTRACT

In this presentation, I will explore some approaches to construct high-fidelity numerical models of composites from X-ray microtomography (μCT). These approaches encompass classical image processing methods to segment the raw data and to extract morphological features as local anisotropy, or to label individual components of the material at hand. The generation of finite element models from these processed images will also be addressed, either using voxel elements or conforming tetrahedral meshes. I will discuss a more recent approach dedicated to textile composites, namely the variational segmentation method, that combine a prior geometric knowledge with an image-based approach to obtain topologically correct models of such materials. The benefits of image-based models, compared to idealized ones, will be illustrated using various thermo-mechanical simulations of carbon/carbon composites and in-situ tests of ceramic matrix composites.

BIOGRAPHY

Since 2012, Guillaume Couégnat is a CNRS research engineer (IR1) at Laboratoire des Composites Thermostructuraux (LCTS), a joint lab between CNRS, Univ. Bordeaux, Safran and CEA, where he is in charge of the computing facilities and acts as co-head of the modeling & simulation activities. His research mainly focuses on the multiscale modeling of composite materials for aerospace or aeronautical high-temperature applications. His interests lie in the simulation of the thermo-mechanical behavior of carbon/carbon and ceramic-matrix composites, and the prediction of their lifetime in service. Guillaume earned a M.Sc in material engineering from Ecole des Mines d'Albi-Carmaux and a M.Sc. in mechanical engineering from Université Toulouse III before completing a Ph.D. in mechanics at Université de Bordeaux on the modeling of woven ceramic-matrix composites.