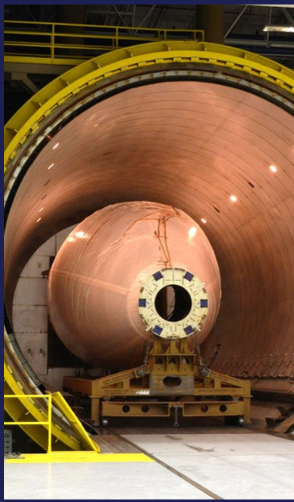
Educational Series
& Academy

COMPOSITE MATERIALS: MODELING, PROCESSING, AND CHARACTERIZATION

The global composite material and structure market is a multibillion sector with continuous growth, with the aerospace, automotive, construction, marine, and wind energy industries being the big players. The drivers of the expansion are the demand for high-performance and lightweight composites due to stringent regulations towards, e.g., less polluting vehicles or save weight. Emission targets are leading to develop lighter-weight, affordable composite structures and components at higher volumes. Conversely, the reduction of manufacturing costs and the increase in processing efficiency represent some of the next decade's challenges.
The design of composites cannot use extensions of the methodologies adopted for metals. Such a strategy may lead to oversizing, let alone the risks arising from a wrong design. Composites are more complex material systems than metals due to their multiscale nature. Brittle orthotropic fibers, ductile isotropic matrices, and soft cores coexist. Such complexity leads to challenging predictive models. E.g., composite structures' damage and failure mechanism is still far from reliable predictions via virtual models and needs high computational costs, precluding structural engineering calculations. Uncertainties in the models lead to safety factors and tests. Therefore, currently, the full spectrum of composites' advantages is not exploitable, and costly experimental tests are necessary.
Other challenges may arise during the manufacturing process; in fact, composite parts are commonly subjected to high pressure and temperature cycles during which thermal/curing-induced free-strains are formed. Mismatch of these free strains at various scales, coupled with mechanical properties' evolution, leads to residual stresses and, consequently, dimensional changes in the cured composite part. The mismatch occurs at the micro-level between constituents (i.e., fiber and matrix), at the meso-level between plies with different orientations, and at the macro-level between the part and the tool via friction and other geometrical constraints. These manufacturing-induced dimensional changes may reduce mechanical performance and pose significant challenges during the assembling of large and complex parts.

Learning objectives:
·Structural models for composites
·Multiscale models and failure analysis
·Processing methods and simulation
·Evolution of properties during processing and characterization methods
·Fabrication process of Boeing 777x and 787
·Safety factor, building block and substantiation of composite aircraft



Target audience: doctoral students, non-academic professionals, and undergraduate students.

Dates and time: 8 and 9 June 2021, 14:00-18:00 CEST; 10 and 11 June 2021, 16:00-18:00 CEST

Speakers

Navid Zobeiry is an Assistant Professor in the Department of Materials Science and Engineering of the University of Washington. He was previously a research associate and lecturer at the University of British Columbia, where he led manufacturing and testing for the Composites Research Network, a collaboration of academic and industry partners to improve composite manufacturing and design. He has collaborated extensively with aerospace and automotive manufacturers and materials suppliers on a wide range of topics throughout his research career, including material and process characterization, process simulation and optimization, and manufacturing-induced defects.

Marco Petrolo is an Associate Professor in the MUL2 Group, Department of Mechanical and Aerospace Engineering of Politecnico di Torino. His research activity deals with the structural analysis of composites, multiscale and micromechanics models; refined beam, plate, and shell models; component-wise approaches and axiomatic/asymptotic analyses.

Registration and Webinar Platform

The registration is mandatory via the online form at the web link.
Deadline: 25 May 2021
Fees: there are no registration fees for AIDAA members. Instructions to become a member can be found here.
Webinar platform: Webex, a link will be sent via email a few days before the event.