



SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS1020

18 November 2025

A DCAMM seminar No. 796 will be presented by

**Senior researcher Frédéric Laurin
ONERA – French Aerospace Lab
Paris-Saclay University, France**

The title of the lecture is

**Determination of the longitudinal compressive strength of unidirectional ply:
review of experimental and modelling challenges**

Abstract:

In the design of aeronautical structures, determining the allowable values associated with failure criteria, particularly the longitudinal compressive strength, remains a key issue for the aeronautical industry. Furthermore, this critical allowable value must be determined at various temperatures representative of flight conditions and in the event of a fire, adding complexity to the multi-instrumented testing procedure and associated analysis methods. This study critically analyzed existing tests to determine the longitudinal compressive strength of various unidirectional (UD) plies at different temperatures (from ambient to 120 °C). The following tests were considered for different composite materials: (i) standard compressive tests on UD plies; (ii) additional bending tests on UD plies; and (iii) an alternative tensile test on a specific lay-up that fails by fiber kinking. The composites studied were a classic aerospace carbon/epoxy material and a carbon/thermoplastic material with the same fibres to highlight the effect of the matrix on the studied strength. All of these tests were highly instrumented to accurately determine the failure scenario and ensure the relevant failure mode was obtained. To analyze such tests (compression, tension and flexure), a micro-mechanical model associated with a damage model defined at the ply scale has been proposed. It has been demonstrated that the variation in longitudinal compressive strength obtained at the unidirectional (UD) ply scale for tensile and flexure tests is consistent when fibre-kinking is considered at the microscopic scale, which appears to be the relevant scale of analysis. Additionally, the influence of the plies' position through the thickness was considered for compression tests, which can also be explained by micro-mechanical modelling.

DATE: **Tuesday, 2 December 2025**

TIME: **10:00 – 10:45**

PLACE: **Building RI503, Room RS67 – Risø Campus
Frederiksborgvej 399, 4000 Roskilde
DTU, Technical University of Denmark**

Virtual participation: [Link](#)

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

All interested persons are invited.

Lars Pilgaard Mikkelsen/Jan Becker Høgsberg

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