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EXPERIMENTALLY CHARACTERIZING THE BEHAVIOUR OF FIBRE REINFORCED COMPOSITE LAMINATES UNDER MULTI-AXIAL LOADING: A HISTORICAL REVIEW AND CURRENT STATE OF THE ART

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ABSTRACT

The mechanical behaviour of fibre reinforced composite laminates under applied loading is a complex process due to a variety of factors including geometry effects at various scales (micro-, meso- and macro-level), complex constitutive responses, and the interaction and competition between progressive damage modes. While the study of fibre reinforced composite laminates under multi-axial loading conditions has been an area of study for over 40 years, the number of experimental studies is limited primarily due to the difficulty in performing relevant experiments. The importance of these types of experiments, however, is critical to help advance the understanding and prediction of laminate response and failure. Improved understanding and predictive capabilities will ultimately lead to the future development of more advanced (and practical) tools which can reduce the cost and effort in designing and qualifying new composite structures.

The objective of this presentation is to provide an overview of the current state of the art and a historical perspective on the evolution of multi-axial testing of fibre reinforced composite laminates, and the its relationship to model development. Additionally, a case study will be presented highlighting the author's own work on multiaxial testing of glass-fibre reinforced tubulars under cyclic/fatigue loading. Future outlooks and potential directions will be discussed.

OUTLINE:
Background – What is the area and why is it important? How long has this been studied.
Objective of Presentation
Outline:
- Purpose of biaxial testing: input or validation of models, constitutive properties, failure prediction (depends on functionality), damage evolution …
- History and review of biaxial testing methods (advantages and disadvantages of various methods including challenges and practicality of tests)
- Relationship between modelling and experiments (e.g. discuss world-wide failure exercise)
- Case study: Biaxial testing of glass-fiber reinforced tubular specimens
- Future outlook and directions