- Project proposal -
Temperature and loading rate effects on transverse cracking in cross-ply laminates

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1. Introduction

Detection and geometric characterization of fiber/matrix interface cracks (or debonds) in carbon and glass fiber reinforced polymers is important to develop a correct understanding of the mechanisms underpinning the onset and propagation of transverse cracks at the microscopic level. Given the many variables at play, a statistical treatment of the problem is unavoidable, which requires large amount of data to provide reliable results. However, characterization of debonds can today be performed on an optical microscope only in a manual, where the operator identifies the debonds and performs the necessary measurements. Automation of these tasks would thus translate into significant gain in terms of a reduced tests' time as well as in an increased number of measurements, and thus more reliable statistics. The development of an algorithm for automatic detection of debonds represents the first towards automating the characterization of the fiber/matrix interface crack.

2. Objectives

Develop an algorithm that, given an image of a ply at 90°, is capable of

1. identify each debond, and for each one
2. measure the radius of the fiber,
3. measure the angular size of the debond,
4. measure the position of the crack tips,

5. measure starting position and direction of kinked cracks,
6. measure angular position and distance of the closest fiber.

3. Materials

Images recorded with the optical microscope of glass and carbon fiber reinforced cross-ply laminates after being loaded in transverse strain.

4. Methods

OpenCV in conjunction with C/C++ or Python. Matlab with its Image Processing and Computer Vision Toolbox is also an option.

5. Expected outcomes

6. Audience

1-2 students for Project Course or Master thesis.