

# CHARACTERIZATION OF DAMAGED COMPOSITE LAMINATES BY AN OPTICAL MEASUREMENT OF THE DISPLACEMENT FIELD

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When a composite is loaded in tension with increasing load it will eventually fail (macroscopically). The failure is preceded by the initiation and evolution of several microdamage modes. On the microscale, a part of the matrix can fail, fibers can fail and there can be fiber/matrix interface debonding. On the mesoscale, the first mode of damage is usually intralaminar cracking in off-axes layers with respect to the main load component. Due to this kind of microdamage a composite undergoes stiffness reduction when loaded in tension.

The degradation of the elastic properties of these materials is caused by reduced stress in the damaged layer which is mainly due to two parameters: the crack opening displacement (COD) and the crack sliding displacement (CSD). Many theoretical analytical and numerical models have been developed to calculate these two parameters [1]. All of them are based on idealized assumptions. For example, assuming linear elastic material behavior even in high stress concentration regions at crack tips as well as in shear loading and assuming idealized geometry of these cracks which would not change during the service life [2]. The main objective of this paper is to measure these parameters for different laminate lay-ups in this way providing models with valuable information for validation of used assumptions and for defining limits of their application.

In particular, the displacement field on the edges of a  $[0/70_4/-70_4]_s$  glass fiber/epoxy laminate specimens with multiple intralaminar cracks is studied and the (COD) dependence on the applied mechanical load is measured. The specimen full-field displacement measurement is carried out using ESPI (Electronic Speckle Pattern Interferometry) [3].

## References

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