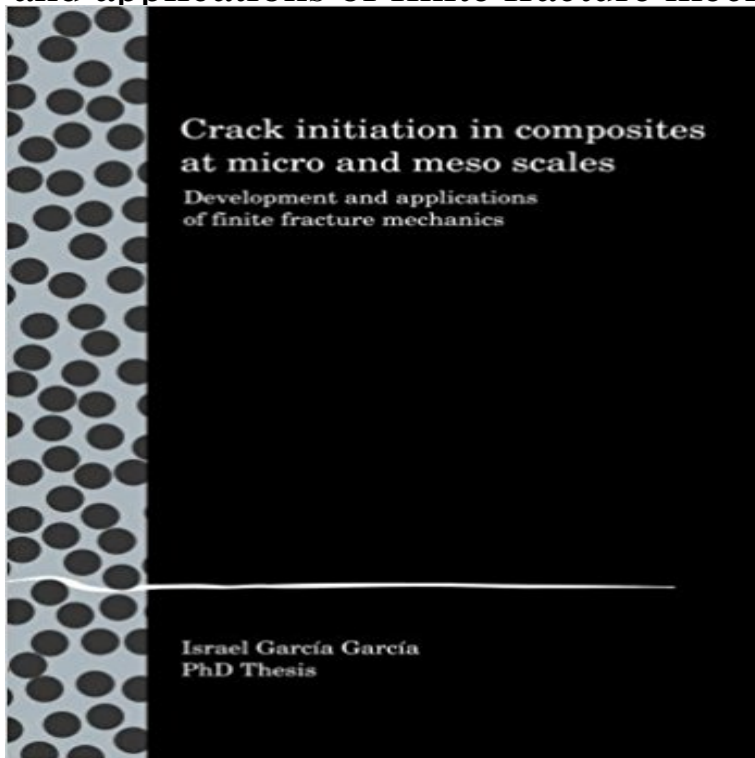


Crack initiation in composites at micro and meso scales: Development and applications of finite fracture mechanics



This thesis deals with the application of the coupled criterion to characterize the first steps of failure mechanisms in composites. The coupled criterion was developed in the context of the finite fracture mechanics and is based on assuming that a crack of a finite extension appears abruptly when a stress criterion is fulfilled and this crack onset is energetically admissible. Using this criterion, the critical load leading to a crack onset can be expressed as a function of well-known physical properties of the material as strength and fracture toughness.

The thesis outline can be divided into two main parts: The first part studies the phenomenon of crack initiation and the failure criterion employed here for its prediction. The controversial concept of crack initiation and the main tool employed to predict it are discussed. The formulation and the practical application of the coupled criterion are also reviewed. The second part describes the application of the coupled criterion to different failure mechanisms at different scales: fiber-matrix debonding under transverse loading in FRC, debonding of spherical inclusions in particle-reinforced composites, transverse cracking in cross-ply laminates and crack initiation at a weak surface in a bonded V-notch.

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