# CONTINUUM DAMAGE MECHANICS: FUNDAMENTALS AND APPLICATIONS

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*Abstract. Continuum Damage Mechanics (CDM), Lemaitre (1992), is a powerful tool to formulate constitutive models to represent the behaviour of solids with diffuse micro cracks distribution induced by deformation. In this article, we start by presenting some fundamentals of CDM such as thermodynamics basis, damage representation, equivalence principles and the couplings between damage and elasticity and damage and plasticity. In the sequence application of CDM is illustrated based on the previous experience of the author. Initially, some issues related to constitutive modelling are addressed. In particular some features of an anisotropy induced damage model are detailed. The so called simplified models within the context of lumped damage and plasticity are treated in the sequence. Nonlinear dynamics concerning mainly to structural damping induced by damage is then considered. All the previous works have been implemented by using the FEM and also non conventional forms of numerical tools. For instance, meshless methods and the generalized finite element method, Nayroles et alli (1992), have been applied as well. Such kind of numerical tools have been developed aiming to better describe the damage distribution and mainly the localized damage zones. Another goal of such researches is related to the simulation of damage to fracture transition. The last section of the work is dedicated to such kind of numerical experiments. Future trends appoint to go further. For instance the combined damage-fracture propagation by using non-conventional finite element formulation is on development. Within the context of material mechanics the aim is to improve recent studies on probabilistic approach to rupture, Hild (1998), in order to properly account for heterogeneities.*
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