

Review of degradation models and their integration in life-cycle analysis

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Time-dependent reliability is commonly approached by evaluating observations of system failures over time. Although this approach is very useful in some practical cases, it leaves out the insights of the process leading to failure; i.e., degradation. Degradation depends on the type of structure and the nature of the external or internal demands (i.e., frequency, intensity, mechanism). Understanding and modeling degradation mechanisms, and the associated uncertainties, has important consequences for defining intervention policies. This paper describes first the complexities of degradation and existing modeling alternatives; afterwards it presents some recent works that use Lévy processes, which provide an alternative to integrate all degradation mechanisms within a single framework. Furthermore, since degradation mechanisms define to large extent maintenance strategies, the paper also discusses existing approaches to maintenance and the need for more realistic approximations. In particular it introduces maintenance models based on optimal control systems. This approach will open new ways of operating structures and infrastructure.