A Time-dependent Framework of Resilience-Driven System Design and Its Application to Wind turbine System Design

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As engineered systems become complex and experience harsh operating condition, system reliability is of greater importance than ever. Currently, most engineered systems incorporate system redundancies to satisfy the required system reliability. However, it could excessively increase life-cycle cost (LCC). In order to resolve this challenge, two engineering disciplines have to be cohesively integrated: reliability-based design optimization (RBDO) and prognostics and health management (PHM). RBDO assures high system reliability in a system development stage while PHM enables continuous system health recovery despite system health degradation. Recently, a newly developed resilient-driven system design (RDSD) makes system resilient with significantly reduced LCC. This paper aims at proposing a time-dependent RDSD framework with three new ideas: (i) time-dependent reliability analysis, (ii) a refined cost model, and (iii) interactive optimization process for enhanced optimal solution. This study is demonstrated with a wind turbine system design problem by using CAE tools from national wind technology center (NWTC) and Numerical Manufacturing And Design Tool (NuMAD) from Sandia National Laboratories.