A time-variant structural reliability analysis method based on the process discretization(TRPD)

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Time-variant reliability problems appear in the engineering practice when random loading modelled as random processes or the material properties of the structure deteriorate in time is involved. In this paper, a new time-variant method called TRPD is presented, which is based on random process discretization. It allows to solve such problem more efficiently , and without using Poisson's approximation or Markov's approximation which is necessary for outcrossing approach. In this method, the stochastic process of the limit-state function is first discretized . Every discretized limit-state function is then linearized at the Most Probable Point, and simplified into the problem of time-invariant structural reliability analysis model. Finally, it is benchmarked with the well-established Monte-Carlo simulation method on three examples, including corroded beam, cantilever tube and engine crankshaft. The TRPD method appears very accurate and convergent in all cases.

Key words: time-variant reliability, process discretization, Monte-Carlo simulation, TRPD method