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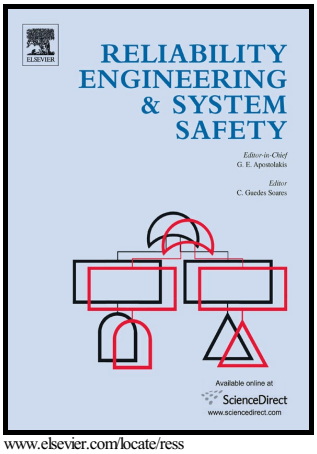

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A methodology based on the Birnbaum-Saunders distribution for reliability analysis applied to nano-materials

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Abstract

The Birnbaum-Saunders distribution has been widely studied and applied to reliability studies. This paper proposes a novel use of the Birnbaum-Saunders model to analyze the effect on hardness, a material mechanical property, when incorporating nano-particles inside a polymeric bone cement. A plain variety and two modified types of mesoporous silica nano-particles are considered. In biomaterials, one can study the effect of nano-particles on mechanical response reliability. Experimental data collected by the authors from a micro-indentation test about hardness of a commercially available polymeric bone cement are analyzed. Hardness is modeled with the Birnbaum-Saunders distribution and Bayesian inference is performed to derive a methodology, which allows us to evaluate the effect of using nano-particles at different loadings by the R software.

Keywords Bayesian analysis; Hardness data; Markov chain Monte Carlo method; R software.

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