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Uncertainty estimation of mechanical testing properties using sensitivity analysis and stochastic modelling

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Abstract: This paper is concerned with a method for uncertainty evaluation of mechanical propertiesin metal testing. This method uses a combined approach based on Monte Carlo simulationand Markov Chain (MCMC) as a computing procedure of different uncertainties of mechanicaland metallurgical parameters such as stress, and elongation. The MCMC is a stochasticmethod that computes the statistical properties of the considered states such as the probabilitydistribution function (PDF) according to the initial state and the target distributionusing Metropolis-Hasting (MH) algorithm. Conventional approach is based on the Guide ofUncertainty Measurement (GUM), the uncertainty budget is established for the stress andelongation parameters respectively. A comparative study between the conventional procedureand the proposed method is given. This kind of approaches is applied for constructingan accurate computing procedure of uncertainty measurement of mechanical and metallurgicalparameters.

Keywords : Markov Chain Monte Carlo (MCMC) Metropolis-Hasting (MH) algorithm Mechanical and metallurgical testing Stress, elongation and hardness measurement Guide of Uncertainty Measurement (GUM)