Predicting the Uniaxial Strength Distribution of Brittle Materials Based on a Uniaxial Test

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Abstract : Brittle fracture failure probability is best described using a stochastic approach which is based on the 'weakest link concept' and the connection between a microstructure and macroscopic fracture scale. A general theoretical and experimental framework is presented to predict the uniaxial strength distribution according to independent uniaxial test data. The framework takes as input the applied stresses, the geometry, the materials, the defect distributions and the relevant random variables from uniaxial test results and gives as output an overall failure probability that can be used to improve the reliability of practical designs. Additionally, the method facilitates comparisons of strength data from several sources, uniaxial tests, and sample geometries.