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FRACTURE OF BRITTLE MATERIALS

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A theory for the failure probability and the tensile strength of brittle materials is developed by using the properties of flaw size distribution and the stress required to fracture an inclined crack. The expression relating the tensile strength to the probability of failure compares well with the extensively used empirical relationship proposed by Weibull. An empirical constant used in the latter is explained in terms of a material parameter.

The theory is extended to treat loading systems such as biaxial tensile and uniaxial compressive loading systems. In the latter case, where the strength is based on the assumption that a certain proportion of cracks must fail prior to the final fracture, the compressive strength should closely follow a normal distribution with its mean independent of volume and variance inversely proportional to volume.