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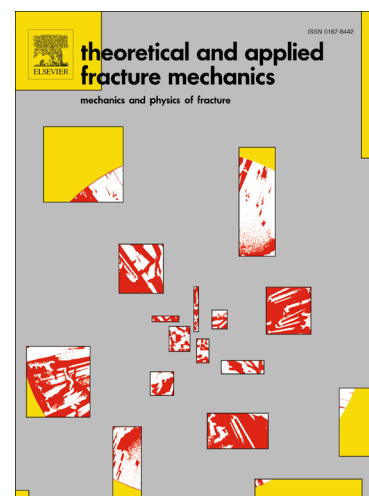
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Influence of Grain Size on Granite Strength and Toughness with Reliability Specified by Normal Distribution

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Abstract: This study presents a simple fracture model linking average grain size G of granite to tensile strength f_t and fracture toughness K_{IC} . This model only requires the peak load P_{max} measurements of small notched samples to determine both f_t and K_{IC} . The influence of G was considered for: (i) quasi-stable crack growth before P_{max} , and (ii) fracture transition from f_t to K_{IC} criterion. In-depth analysis was carried out on three-point-bending (3-p-b) results from granite with $G \approx 2.5$ mm. The 3-p-b specimens have two different beam widths $W = 30$ and 70 mm, and the same span/width ratio S/W of 4. Another granite with $G \approx 10$ mm reported in literature was also analysed to show the influence of different grain size on both f_t and K_{IC} . Comprehensive data on rock fracture are explained and compared with the results of this study to substantiate findings of this study. Experimental scatters in P_{max} with different initial notch lengths $a_0 = 0 - 53$ mm were analysed by normal distribution, following a recent study [Zhang et al., 2018]. The new model with normal distribution predicted the mean and upper and lower limits with 96% reliability covering the experimental scatters.

Keywords: Fracture toughness; Polycrystalline material; Granite; Probability and statistic; Size effect

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