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THE DOUBLE TORSION LOADING CONFIGURATION: A DETAILED NUMERICAL STUDY

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In the last thirty years, the double torsion constant configuration technique has been the standard for measuring subcritical crack propagation. The great advantage of this technique is that it provides a very stable crack growth, allowing comparatively easy and repeatable measurements of the fracture parameters of brittle materials. Among the latter, rocks are of main interest for developing models of seismic and volcanic events. In spite of its popularity, the double torsion configuration has a very complex three-dimensional strain field, so far still unknown in the detail. This field has been strongly oversimplified in the standard application, although its detailed knowledge is necessary to obtain reliable crack velocity vs. stress intensity factor measurements. We performed an accurate three-dimensional finite element analysis of the problem to estimate the influence of the width to thickness ratio of the specimen, of the fracture length, of the shape and dimensions of the side groove, of the initial notch, and of the curved shape of the fracture front. The results obtained are likely to drastically reduce the discrepancies between the measurements made in different laboratories, which have traditionally prevented the development of fracture models which are practically effective.

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