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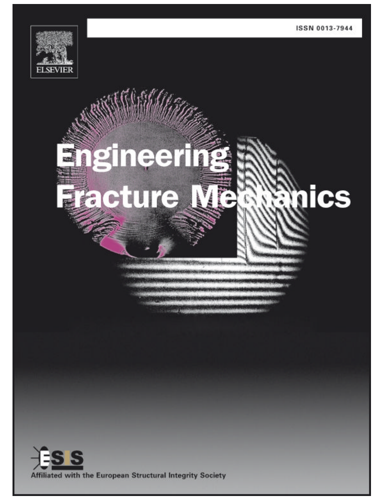

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A theoretical model for hydraulic fracturing through a single radial perforation emanating from a borehole

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Abstract: This paper considers the problem of the plane-strain fluid-driven fracture propagation of a single radial perforation emanating from a borehole. A maximum tangential strain criterion is proposed to study crack propagation during hydraulic fracturing; this criterion considers the changes in not only the mode-*I* stress intensity factor caused by the pore pressure but also the mode-*II* stress intensity factor caused by the anisotropy of the far-field stress. The critical water pressure and the critical initiation angle at the onset of crack propagation are studied using the proposed theoretical method. The effects of the stress anisotropy coefficient, the borehole radius, the perforation length, the ratio of the water pressures inside the fracture to that of the borehole, Biot's coefficient and Poisson's ratio on both the critical water pressure and the critical initiation angle are discussed. The parameter analysis indicates that the perforation length, the borehole radius and the stress anisotropy coefficient significantly affect the critical water pressure and the critical initiation angle. The critical water pressure decreases as the ratio of the water pressure inside the fracture to that of the borehole and Biot's coefficient increase, whereas the critical initiation angle is not affected by these parameters. The

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