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Effect of shear-span/depth ratio on cohesive crack and double-*K* fracture parameters of concrete

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Abstract. A numerical study of the influence of shear-span/depth ratio on the cohesive crack fracture parameters and double – *K* fracture parameters of concrete is carried out in this paper. For the study the standard bending specimen geometry loaded with four point bending test is used. For four point loading, the shear – span/depth ratio is varied as 0.4, 1 and 1.75 and the ao/D ratio is varied from 0.2, 0.3 and 0.4 for laboratory specimens having size range from 100 – 500 mm. The input parameters for determining the double – *K* fracture parameters are taken from the developed fictitious crack model. It is found that the cohesive crack fracture parameters are independent of shear-span/depth ratio. Further, the unstable fracture toughness of double-*K* fracture model is independent of shear-span/depth ratio whereas, the initial cracking toughness of the material is dependent on the shear-span/depth ratio.

Keywords: four-point bend test; shear-span depth ratio; cohesive crack fracture parameters; double-*K* fracture parameters; weight function; cohesive stress

1. Introduction

The principle of linear elastic fracture mechanics (LEFM) was first applied by Kaplan (1961) to notched concrete beam for determining the critical stress intensity factor of concrete. Thereafter, until early 1970s numerous experimental and numerical investigations using linear elastic fracture mechanics were carried out to study the fracture process and crack propagation of concrete. From the studies, it was understood that LEFM could be only applied to large-mass concrete structures and could not be applied to medium and small-scale concrete structures. The inapplicability of LEFM is attributed mainly to the nonlinear effects associated with crack propagation in concrete. It is well understood that before the development of unstable crack, due to the aggregate interlocking property, there exists a large fracture process zone ahead of initial crack tip, which is primarily responsible for the size effect behavior. Since late 1970s, many nonlinear fracture models incorporating the tension softening property of the material have been developed by various groups of researchers to study the behavior of crack propagation in *quasibrittle* materials

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