Chapter 6
Comparison of Fracture Parameters of Concrete Using Nonlinear Fracture Models

6.1 Introduction

From the past studies it is clear that the fracture mechanics can be a useful and powerful tool for the analysis of growth of distributed cracking and its localization in concrete if the softening behavior of the material is taken into account. The presence of FPZ causes size-effect behavior in concrete structures. Various fracture models such as two-parameter fracture model, size-effect model, effective crack model, and double-*K* fracture model (Planas and Elices 1990, Karihaloo and Nallathambi 1991, Kumar and Barai 2010) can also predict this size-effect behavior. The size-effect study of fracture parameters obtained from two-parameter fracture model, effective crack model, double-*K* fracture model, and double-*G* fracture model is presented in this chapter. The studies carried out in subsequent sections are based on the work of Kumar and Barai (2008, 2009a, b, 2010) and Kumar (2010). Results of fictitious crack model for three-point bending test geometry of cracked concrete beam of laboratory size range 100–400 mm are used and the different fracture parameters from size-effect model, effective crack model, double-*K* fracture model, and double-*G* fracture model are evaluated using the input data obtained from FCM. In addition, the fracture parameters of two-parameter fracture model are obtained using the mathematical coefficients available in literature (Planas and Elices 1990). From the study it is concluded that the fracture parameters obtained from various nonlinear fracture models are influenced by the specimen size and they maintain some definite interrelationship depending upon the specimen size and relative size of initial notch length.

6.2 Material Properties and Determination of Fracture Parameters

Fictitious crack model or cohesive crack model for standard specimens of three-point bending test as shown in Fig. 2.11a (see Sect. 2.6) is used in the present study. The discretization as shown in Fig. 4.25a (see Sect. 4.9) is considered along with the quasi-exponential stress–displacement softening relation (Planas and Elices

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