TWO- AND THREE-DIMENSIONAL CRACK PROPAGATION ANALYSES USING A NODE-BASED FINITE ELEMENT METHOD

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Several computational methods have been presented to overcome the troublesome process regarding mesh generation for structural analysis. However, even though the methods exhibit excellent performance in some specific fields, those have not been succeeded in completely replacing the FEM analysis. The primary reason is that the methods have a weak point in detailed modeling required to apply for practical engineering problems. In order to resolve the problems, recently, several FEM-based mesh-free methods have been reported.

The Free Mesh Method(FMM) is one of the FEM –based mesh-free methods and has been progressed continuously from the original one. It has been successfully applied already to two-dimensional problems in several fields. The purpose of this research is to introduce an extended application of the FMM for three-dimensional geometries and/or boundary conditions. A parallel computing is being facilitated both in robust local mesh generator and crack evaluation solver. In order to check the validity of FMM, a series of quasi-static fracture mechanics analyses have been carried out for varying crack geometry. Thereafter, promising prototypal results were obtained and will be utilized to assure integrity of structural components.

Figures 1 to 3 show computational result for the splitting test of concrete cylinder using the present method.

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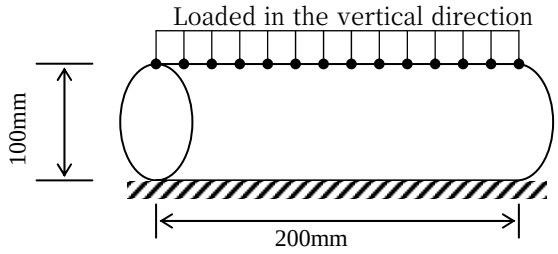


Fig.1 Splitting test of concrete cylinder

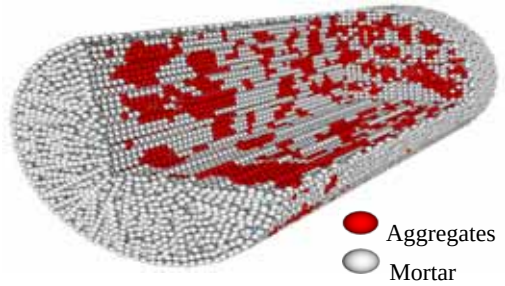
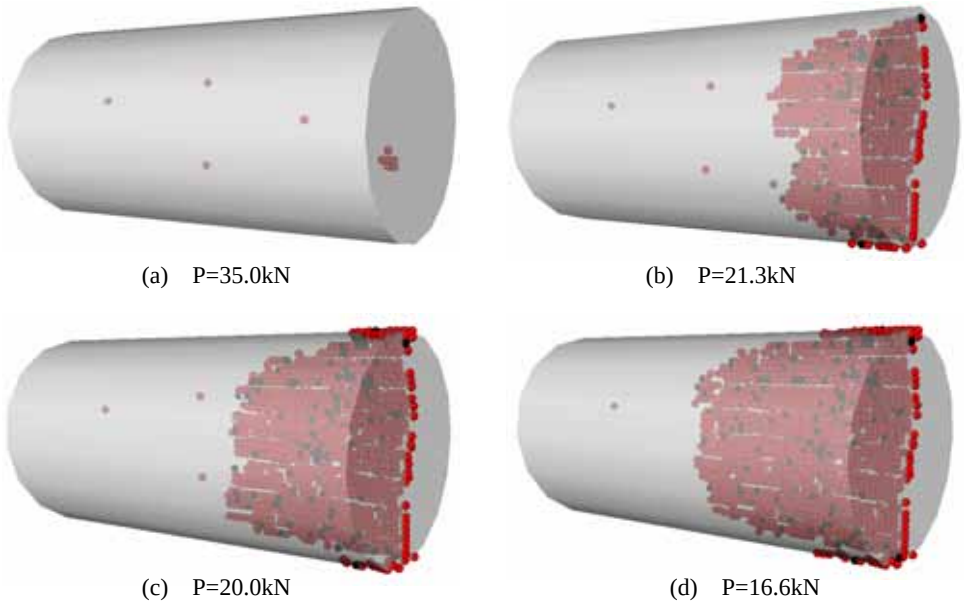


Fig.2 Distribution of coarse aggregates



(a) P=35.0kN (b) P=21.3kN

(c) P=20.0kN (d) P=16.6kN

Fig.3 Crack propagation