

Discrete crack modelling of RC structure using hybrid-type penalty method

***Y. Fujiwara¹, N. Takeuchi¹, T. Shiomi² and A. Kambayashi³**

¹Graduate School of Engineering and Design, Hosei University, 2-33 Ichigaya Tamachi, Shinjuku, Tokyo, Japan.

²Mind Inc., 7-17-19 Maebara-nishi Funabashi Chiba, Japan.

³ Research & Development Institute, Takenaka Corporation, 1-5-1 Ohtsuka, Inzai, Chiba, Japan.

*Corresponding author: fujiwara.yoshihiro@3d-lab.jp

The hybrid-type penalty method (HPM) is suitable for representing failure phenomena occurring during the transition from continua to discontinua in materials such as concrete. Initiation and propagation of dominant cracks and branching of cracks can easily be modeled as a discrete crack. The HPM represents a discrete crack by eliminating the penalty that represents the separation of the elements at the intersection boundary. This treatment is easy because no change in the degrees of freedom for the discrete crack is necessary. In addition, it is important to evaluate the correct deformation of the continua before the crack formation is initiated. To achieve this, we implemented a constitutive model of reinforced concrete for the HPM. In this paper, we explain the implemented constitutive model and describe the simulation of a deep beam test using the HPM and demonstrating its capability for evaluating progressive failure.

Keywords: Hybrid-type penalty method, Discrete crack, Concrete structure