FINITE ELEMENT MODELLING OF UHPFRC ELEMENTS

Eduardo J. Mezquida-Alcaraz, Juan Navarro-Gregori, Pedro Serna Ros

Institute of Science and Concrete Technology, ICITECH, Universitat Politècnica de València, València, 46022, Spain

Abstract

Nowadays the characterisation of Ultra-High Performance Fibre-Reinforced Concrete (UHPFRC) tensile behaviour still remains a challenge for researchers. For this purpose, a simplified closed-form non-linear hinge model based on the Third Point Bending Test (TPBT) was developed by the research group. This model has been used as the basis of a simplified inverse analysis methodology to derive the tensile material properties from load-deflection response obtained from TPBT experimental tests.

The aim of this work is the numerical validation of the simplified inverse analysis method to characterise the tensile properties of UHPFRC. To get this objective a Finite Element Model (FEM) is carried out in Diana software. The parameters to characterize the concrete properties from the simplified inverse analysis method by means of TPBT are used in the numerical modelling. The constitutive model for UHPFRC is modelled using two assumptions. One is based on the smeared cracking approach where a fixed total strain crack model, expressed as function of a crack opening fibre-reinforced concrete fib curve, is used. The other is based on a discrete cracking model for the macrocrack position. Numerical validation accuracy is reasonable for the smeared crack case and good for the discrete crack approach.

Moreover, an application of the model in uniaxial tensile UHPFRC elements has been carried out with the objective of study, not only the particular cracking process of UHPFRC, but the interaction between the different types of reinforcement and the matrix of this concrete.