FINITE ELEMENT MODELLING OF UHPFRC FLEXURAL-REINFORCED ELEMENTS

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Abstract

A simplified closed-form non-linear hinge model to derive the tensile material properties of Ultra-High Performance Fibre-Reinforced Concrete (UHPFRC) from load-deflection response obtained from Third Point Bending experimental Tests (TPBT), and its numerical validation using a Finite Element Model (FEM) developed in Diana software was presented in The 12th International DIANA Users Meeting hold in Porto. The numerical model developed is based on the discrete cracking model as interface behavior on the central beam section where the macrocrack position is forced to take place, and a smeared cracking approach where a fixed total strain crack model, expressed as function of a crack opening fibre-reinforced concrete fib curve, in the rest of the beam. As it was demonstrated, this model showed good accuracy in a set of TPBT specimens made of UHPFRC with strain-hardening constitutive behaviour.

Now, the numerical model has been used in order to validate the closed-form non-linear hinge model when UHPFRC shows both soft-hardening and soft-softening constitutive behaviour. It seems that running the FEM using the parameters obtained from the non-linear hinge model in a TPBT as a UHPFRC's constitutive behaviour in these cases shows a slight conservative response in tension.

Moreover, soft-hardening and soft-softening UHPFRC TPBT's specimens reinforced with longitudinal steel bars have been tested experimentally and modelled using the FEM developed. The tensile parameters of UHPFRC obtained using the simplified closed-form non-linear hinge model have been used to define the constitutive behaviour of the FEM. High accurate results for this new type of specimens and a very stable response of the model due to the presence of the reinforcement have been obtained, despite the slight conservative response previously observed in non-reinforced specimens.