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Analytical Study of Flexural Strength of Concrete-Filled Steel Tube Beams

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Abstract : In this research, analytical study of the flexural strength of Concrete Filled Steel Tube (CFST) beams is carried out based on wide-range finite element models to obtain the better perspective for flexural strength achievement with the use of ABAQUS finite element program. This work adopts concrete damaged plasticity model to get the actual simulation of CFST under bending. To get the decent interaction between concrete and steel, normal and tangential surface interaction provided by ABAQUS is used with hard contact for normal surface interaction and for 0.65 friction coefficient for tangential surface interactions. In this study, rectangular and square CFST beam model cross-sections are adopted with its limits pertained to Eurocode specifications. To get the visualization for flexural strength of CFST beams, total of 74 rectangular CFST beams and 86 square CFST beams are used with four-point bending test setup and the length of the beam model as 1000mm. The grades of concrete and grades of steel are used as 30 MPa & 35MPa and 235 MPa and 275MPa respectively for both sections to get the confinement factor 0.583 to 2.833, steel ratio of 0.069 to 0.236 and length to depth ratio of 4.167 to 16.667. It was found based on this study that flexural strength of CFST beams falls around strain of 0.012. Eurocode provides the results harmonically with finite elemental results. It was also noted for square sections that reduction of steel ratio is not useful as compared to rectangular section although it increases moment capacity up to certain limits because for square sectional area similar to that of rectangular, it possesses lesser depth than rectangular sections. Also It can be said that effect of increment of grade of concrete can be achieved when thicker steel tube is present. It is observed that there is less increment in moment capacity initially but after D/b ratio 1.2, moment capacity of CFST beam rapidly.

Keywords : ABAQUS, CFST beams, flexural strength, four-point bending, rectangular and square sections
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