National Institute of Technology Rourkela

Registration Seminar

Seminar Title : Fracture Performance Study of Plain and Reinforced Concrete

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Venue : Seminar hall Department of Civil Engineering

Date & Time : 01 Jun 2023 (10.30 am)

Abstract : Fracture and fatigue studies in concrete play a crucial role in determining the service life of structures. Concrete being a quasi-brittle material, exhibits non-linear softening in post-peak regions of stress-strain curve. This non-linear response of concrete is attributed to the energy dissipation in formation of an inelastic zone of microcracking called Fracture Process Zone (FPZ). Various toughening mechanisms occur inside the FPZ, that impart a resistance to failure of material. Thus, a precise estimation of FPZ size is necessary. In this study, an attempt has been made to estimate the width of FPZ using DIC analysis. The proposed methodology has been validated by statistical analysis and existing literature data. Additionally, the behaviour of Reinforced Concrete (RC) beams has been studied under the action of fatigue loading. A parametric study has been done to study the variation of reinforcement percentage and structural size on fatigue life. An existing crack growth model considering the effect of bond-slip and corrosion has been validated with existing literature. For the future scope of study, a multiscale analysis of key fracture parameters at different scales is proposed. Variations of fracture toughness, fracture energy, and fracture process zone size will be studied at mesoscale and atomic scale level for fatigue loading. An analytical model will be developed for estimating the fatigue life of structures based on the meta-physical concept of space scaling. The newly developed finite similitude theory will be further explored to study the fracture behaviour in concrete structures. Finite element analysis will be performed to validate the applicability of proposed model. The overall study will be concluded by prediction of fracture processes using Deep Learning (DL) approach. The time dependent strain history will be further analysed using convolution and recurrent type neural networks to predict the crack propagation in concrete.