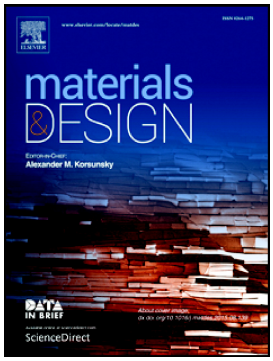
Accepted Manuscript



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PII: S0264-1275(16)31544-1
DOI: doi: 10.1016/j.matdes.2016.12.027
Reference: JMADE 2572

To appear in: *Materials & Design*

Received date: 17 June 2016
Revised date: 2 December 2016
Accepted date: 10 December 2016

Please cite this article as: Yu Su, Jun Li, Chengqing Wu, Pengtao Wu, Ming Tao, Xibing Li , Mesoscale study of steel fibre-reinforced ultra-high performance concrete under static and dynamic loads. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2016), doi: 10.1016/j.matdes.2016.12.027

Mesoscale study of steel fibre-reinforced ultra-high performance concrete under static and dynamic loads

Yu Su[1], Jun Li[2], Chengqing Wu[2*], Pengtao Wu[3], Ming Tao[4], Xibing Li[4]

[1]School of Civil, Environmental and Mining Engineering, the University of Adelaide, SA, Australia 5005

[2]Centre for Built Infrastructure Research, School of Civil and Environmental Engineering, University of Technology Sydney, Australia

[3]Tianjin Key Laboratory of Civil Structure Protection and Reinforcement, Tianjin Chengjian University, Tianjin 300384, China

[4]School of Resources and Safety Engineering, Central South University, Changsha, Hunan, China

Abstract

In this paper, a three-dimensional numerical model to study the static and dynamic behaviour of ultra-high performance steel fibre reinforced concrete is developed. Ultra-high performance steel fibre reinforced concrete is assumed to be a two-phase model consisting of concrete matrix and steel fibres. The concrete matrix is modelled with homogeneous material and the straight round steel fibres are assumed to be dispersed with random locations and orientations in the matrix. The interfacial transition zone (ITZ) effect is studied based on the single fibre pull-out tests, and parameters describing the fibre-matrix one dimensional bond-slip behaviour are obtained and discussed based on both experimental and theoretical results. After the three-dimensional model is validated with static split tensile tests, split Hopkinson pressure bar (SHPB) split tensile tests are numerically modelled and the stress-time history is interpreted in the mesoscale level. The proposed model qualitatively and quantitatively predicts the material static and dynamic behaviours, and also gives insights on the fibre reinforcement effect in the concrete matrix.

*Corresponding author. Email: Chengqing.wu@uts.edu.au