2D Multi-scale Simulation and Homogenization of Foamed Concrete Containing Rubber Bars

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ABSTRACT

One of new innovation in modified concrete is foamed concrete containing rubber bars. The function of rubber on foamed concrete is to improve the strength and enhance the resistance toward high strain rate loadings. The production of foamed concrete containing rubber bars, therefore, leads to the heterogeneous material condition or so-called composite. Mostly, the investigations of strength and material properties of modified concrete are conducted using experimental approaches with various parametric and proportions. This study, however, intends to numerically analyse the strength and elastic properties of foamed concrete containing rubber bars through multi-scale simulation. The unit cell consists of foamed concrete and rubber bar was modelled using the hybrid finite-discrete element method. The damage model of rotating crack was defined on foamed concrete, while rubber bar remain as elastic. It was revealed that foamed concrete containing 5 mm diameter of rubber bars with proportion below that 3 % produces optimum strength. Results that obtained from multi-scale simulation show a favourable agreement with that obtained from experimental study and rule of mixtures.

KEYWORDS: Multi-scale simulation; Rule of mixtures; Foamed concrete; Rubber bar; Hybrid finite-discrete element method

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