Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : MEFTAH Given names : Fekri

Status (prof., assistant prof., …) : Professor

Laboratory : Laboratoire de Génie Civil et Génie Mécanique Website address : http://geosax-lgcgm.insa-rennes.fr/

Institution : INSA Rennes Website address : www.insa-rennes.fr

Scientific competence of the supervisor:

Multi-physics and Multi-scale modelling in porous construction materials
Finite element modelling and numerical programming
Mechanics and physics of materials
Probabilistic methods in engineering

Two major publications in the field proposed for the PhD :

1. F. Meftah et al. A three-dimensional staggered finite element approach for random parametric modeling of thermo-hygral coupled phenomena in porous media. Int. J. Numer. Anal. Meth. Geomech., 36, 574-596
2. F.Meftah, S.Dal Pont, Staggered Finite Volume Modeling of Transport Phenomena in Porous Materials with Convective Boundary Conditions, Transport in Porous Media, 82/2, 275-298.

Website address of the personal page :

Supervisor's email : Fekri.Meftah@insa-rennes.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV 6, IV 7, IV 12, V

Title : On modeling the effects of polypropylene fibers on preventing spalling hazard for high and ultra-high performance concretes when exposed to fast development fires

Subject :

Concrete spalling due to re exposure may be a vulnerability of concrete structures. The phenomenon manifests as a breakdown of concrete layers which flake into small pebble-like pieces at the material surface exposed to fire. Besides the reduction of the concrete resistant cross section, spalling may also lead to a direct exposure to flames of steel rebars which increases the risk of precocious failure of the structure.
It is well established now that adding polypropylene fibers (PPF) to concrete (PPF-concrete) is an embedded solution that may reduce spalling occurrence by conferring to the material self-protection features against fire hazard. High temperature induced degradation of PPF gives progressively rise to a network of micro-channels (corresponding to the space initially filled by PPF: fiber beds) whose connectivity contributes to the increase of hot permeability of PPF-concrete. This evolution (on demand) of the microstructure allows reducing pore pressures which are a major driving mechanism of fire induced spalling.
Nevertheless, adding PPF affects other concrete performances required by design. Therefore, it is crucial to be able to design PPF-concretes with optimal contents of PPF fibers in order to satisfy all design requirements: workability during concrete pouring, mechanical performance and durability during service-time and stability during a fire.

Keywords :

Civil Engineering – Concrete – Fire Resistance – Fire Induced Spalling – Polypropylene Fibers – Finite Element Modeling – Thermo-Hygro-Mechanical Modeling – Mesoscale and macroscale approach.

Expected collaborations :

Actual collaboration with industrial partners in the domain of construction of tunnels.

Background required from the applicant :

Skills in:
- Mechanics and Physics of Building Materials / Numerical Methods in Engineering (Finite Element Modeling…)

Knowledge of the following area will be a plus:
- Construction materials / Probabilistic methods in engineering / Matlab programming

Existence of a PDF file detailing the proposal ("yes" or "no") : YES

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