**Simulation of self-compacting concrete flow in J-ring using smoothed particle hydrodynamics**

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With the recent tendency towards the use of computer modelling in concrete technology, its applications in self-compacting concrete (SCC) is in demand and increasingly becoming an important issue. In this regard, one of the important approaches offering considerable potential is the smoothed particle hydrodynamics (SPH). It is able to simulate flows that contain particles of different sizes and large deformations. SPH is a particle-based method (it does not require re-meshing) to represent with an acceptable level of accuracy the rheological behavior of heterogeneous flow. This method has been examined and proved to be efficient and accurate in modelling the flow of SCC in the cone slump flow and L-box tests. The goal of this paper is to extend its application to simulating the flow of SCC in a J-ring test.

In this study, SCC is regarded as a non-Newtonian incompressible fluid whose behavior is described by a Bingham-type model, which contains two material properties: the yield stress and the plastic viscosity. For the investigated mixes, the former was predicted in an inverse manner using the SPH simulation and the latter was estimated by a micromechanical procedure from the known plastic viscosity of the paste and the SCC mix proportions.

The comparison of simulation results with experiments shows that the proposed methodology (SPH) is efficient to predict accurately the behavior of SCC in the sense that the simulated mixes meet the passing ability criterion and the shapes and diameters of the flow spread are nearly the same as observed in the laboratory test. SPH simulation is therefore an indispensable and cost-effective tool for understanding the behaviour of fresh SCC replacing time-consuming laboratory tests, thereby saving time, effort and materials.

**Keywords**: Self-compacting concrete (SCC); Smoothed particle hydrodynamic (SPH); Non-Newtonian fluid; J-ring test; plastic viscosity.