

MICROMECHANICS OF ELASTO-PLASTIC FIBER PULL OUT OF ELASTIC MATRIX

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It has been proven by many researchers that the overall behavior of concrete can be improved by the addition of fibers. In the present investigation numerical (FEM) modeling of elastically plastic single straight fiber pull-out of elastic matrix volume was realized. Comparison was done with steel fiber is pulling out of concrete matrix. Fiber pulling out micromechanics is governing the macro-crack opening process - fiberconcrete post cracking load bearing capacity is dependent on the each single fiber pull-out process.

Fiber is behaving elasto-plastically. Numerical modeling was performed using 3D FEM approach, which takes into account the non-linearity is presenting in physical model in combination with a finite element method (FEM). Straight shape fiber pulling out of concrete block in fiber direction was investigated in (Li et al., 1998; Mobasher et al., 1995). In our investigation numerical modeling was performed for straight shape fiber was embedded into elastic matrix under variable angle to applied pulling force and at variable depth.

Experimental data analysis shown that the pull-out process can be divided into three stages- a) fiber pull-out with perfect bond between fiber and concrete matrix; b) fiber pull-out with partial debond (cylindrical crack) between concrete matrix and fiber, started from concrete matrix surface; c) fully debonded fiber pull-out of concrete matrix. All above mentioned stages were investigated theoretically (using Solid Works and ANSYS software) and experimentally. Stress distribution acting across the fiber/matrix interface are obtained in each time step of simulation for further prediction of different shape fiber pull-out behavior (Krasnikovs et al. 2009; Krasnikovs et al. 2010).

References

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