MECHANICAL PROPERTIES OF A LAYERED FIBERCONCRETE STRUCTURE

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Layered beams with different short fibers content in plies were fabricated. Beams were tested under four point bending conditions. Increasing applied load macro-crack is started at the bottom side of the beam. Material fracture process was modeled, based on single fiber pull-out laws, which were determined experimentally (for straight fibers, fibers with end hooks and corrugated fibers). For this purpose experimental program was realized and pull-out force versus pull-out fiber length was obtained (for fibers embedded into concrete at different depth and under different angle). Macro-crack is growing and opening. Position of a neutral line in a crack cross-section is changing, depending on the size of crack and was determined summarizing forces caring by fibers in crack opened part (chaotic and oriented fibers distributions in the plies were investigated. Monte-Carlo approach was used) and linear stress distribution in plies across the virgin part of the beam. In Fig. 1, position of the neutral line in two layers beam during macro-crack growth is shown.

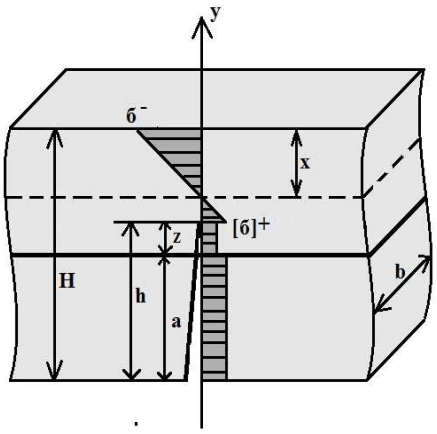

Fig. 1. Stress and loads distribution in crack's plane for two layers fiberconcrete beam.

Depending on a crack size and opening, different crack parts (along the crack) are bearing different load. As the load carried by each fiber at a constant crack opening is known from micro-mechanical investigations, the corresponding total bending load P for a beam was obtained through equilibrium conditions. Modeling results were compared with bending experiments for beams consisting of one to five layers and different fibers content in plies. Prediction results were discussed. Model predictions were validated by 15×15×60 cm prisms four-point bending tests. Fracture surfaces analysis was realized for broken prisms with the goal to improve elaborated model assumptions.