MODEL FOR PARAMETER ESTIMATION FROM CRACK GROWTH IN CONCRETE

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Three point bending of concrete beams is an important test for establishing of material parameters. In out previous works [1,2] we have dealt with pure tension experiments while here we are developing a novel, two purpose mathematical model to be used for description of 3-point bending laboratory experiments and for parameter extraction from experiment results. The model extends the well-known m-κ model permitting discontinuous function for behavior of concrete - $f_c(\varepsilon)$ and of reinforcement -$f_a(\varepsilon)$ (if present). The problem is described with a pair of nonlinear equations (1) where κ is curvature of the beam at the point of fracture.

$$\mathrm{F}(\varepsilon,\kappa) = \Delta a\, f_a[(h_0 - \varepsilon\, h)\tan(\kappa)] + \Delta h \sum_i^{layers} f_c[(h_i - \varepsilon\, h)\cdot\tan(\kappa)] = 0$$

$$\mathrm{M}(\varepsilon,\kappa) = \Delta a\,(h_0 - \varepsilon\, h) f_a[(h_0 - \varepsilon\, h)\tan(\kappa)] + \Delta h \sum_i^{layers}(h_i - \varepsilon\, h)\, f_c[(h_i - \varepsilon\, h)\tan(\kappa)] = \mathrm{M}_0 \quad (1)$$

Result of the equation above is depicted in Figures 1a and 1b.

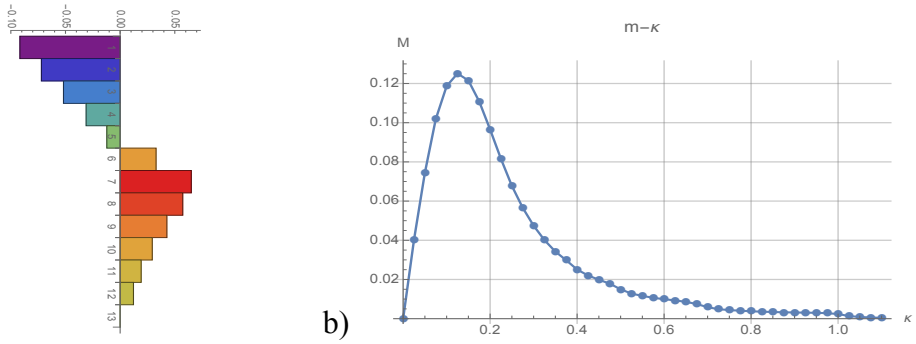

Fig. 1. Concrete cross-section m-κ model: a) force distribution when m=0.1 Nm; b) m-κ dependance.

The main goal of this model is extraction of un-measurable material parameters from experimental results. The proposed model is capable of mimicking the experimental results and inverse model for parameter determination is under development.

References

[1] Kožar I, Torić Malić N, Simonetti D, Smolčić Ž. Bond-slip parameter estimation in fiber reinforced concrete at T failure using inverse stochastic model. Engineering Failure Analysis. 2019; 104: 84-95.
[2] Kožar I, Torić Malić N, Simonetti D, Božić Ž. Stochastic properties of bond-slip parameters at fibre pull-out. Engineering Failure Analysis. 2020; 111: 104478.

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