Numerical simulations of corners in RC frames using Strut-and-Tie Method and CDP model

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ABSTRACT

Corners of reinforced concrete (RC) frames are such elements of structure which are under complex stress conditions where Bernoulli's law is not fulfilled. Reinforcement of the corners should be carefully thought and placed. Wrong pattern and amount of reinforced may cause low efficiency factor of the corner and too large crack width and propagation.

In the paper numerical analyses of RC frame corners under opening moment are presented using different reinforcement patterns investigated in [1], [2]. Following corners are analysed:
- the corner without any stirrups and diagonal bars - only loop-shaped main bars,
- the corner with one diagonal bar,
- the corner with three parallel diagonal stirrups,
- the corner with three fan-shaped stirrups,
- the corner with diagonal bar and diagonal stirrups.

The corners differ not only with reinforcement details, but also with cross-section heights of column and beam joining the corner. The case of different column and beam cross-section heights is not described in Eurocode [3], so the results gained for this corner type is very important for design practise.

The calculations are performed both with Strut-and-Tie Method and Abaqus code using concrete damage plasticity (CDP) model. This is a standard model available in Abaqus having its origin in works of Lubliner and his co-workers [4]. The model is widely used however a proper calibration of its parameters is still an open issue. In the paper the following parameters, which an Abaqus user should define are analysed:
- the viscosity parameter,
- the dilation angle in p-q plane,
- the flow potential eccentricity,
- the ratio of initial biaxial compressive yield stress to initial uniaxial compressive yield stress.

To establish their proper values numerical simulations are performed concerning uniaxial and biaxial compression (including softening of material) and compared with experimental results of Kupfer [5]. On this basis a calibration of CDP model is made.

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