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Numerical simulation of partial-interaction load-deflection behavior of corroded reinforced concrete beams based on a segmental approach and evaluation of reinforcement corrosion level

Key words:

Reinforced concrete, Corrosion, Partial interaction, Load-deflection, Tension-stiffening, Bond-slip



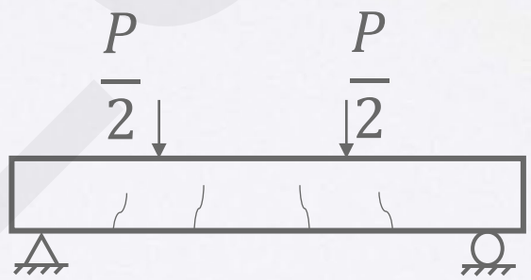
Purpose:

- Get load-deflection curves for corroded RC beams
- Evaluate corrosion levels of reinforcement in RC beams based on the measured load-deflection curves

Methodology:

Traditional M/χ Analysis

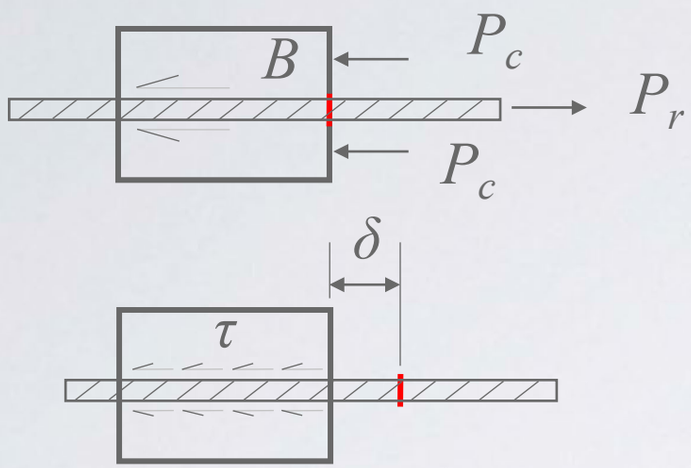
- Strain-based
- Semi-empirical after cracking



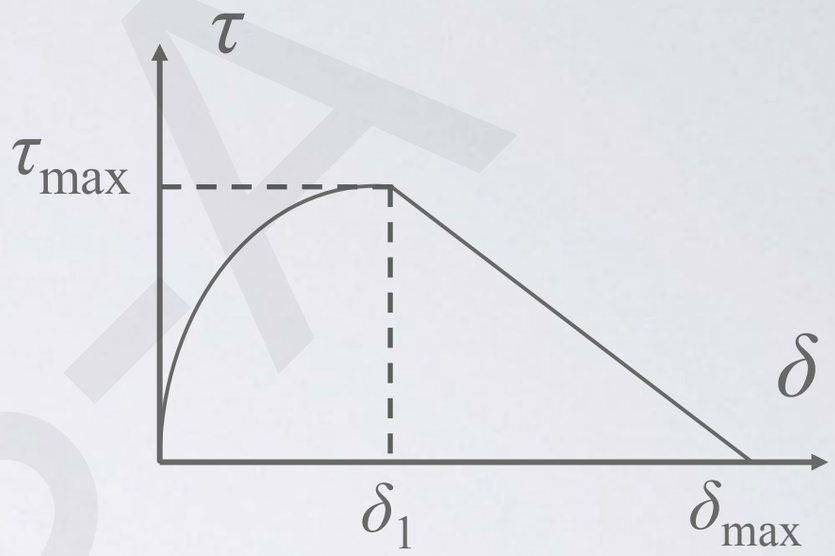
Segmental approach

- Displacement-based
- Allowing for tension-stiffening after crack

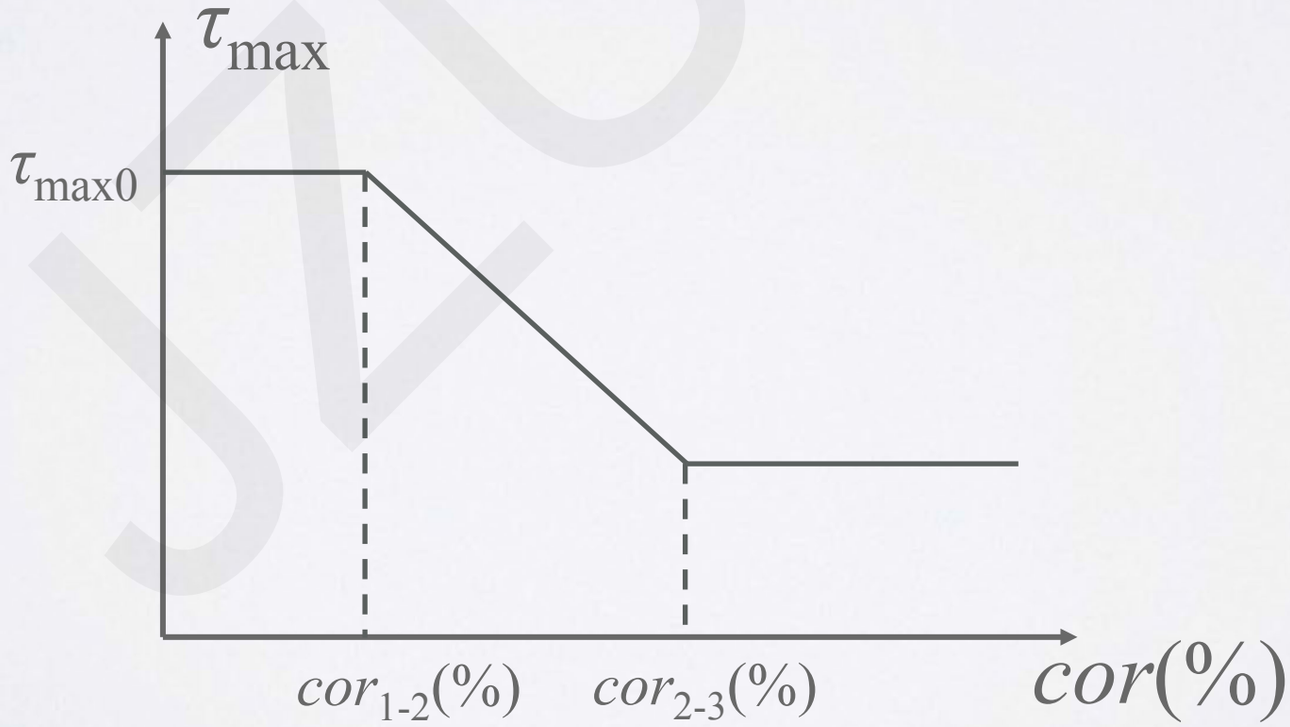
Bond-slip properties:



$$\tau = \mathrm{f}(\delta)$$



Bond strength with corrosion:



Procedures:

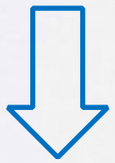
Bond-slip & Material properties



Segmental approach



M/θ (M/χ) relationship



Load-deflection response

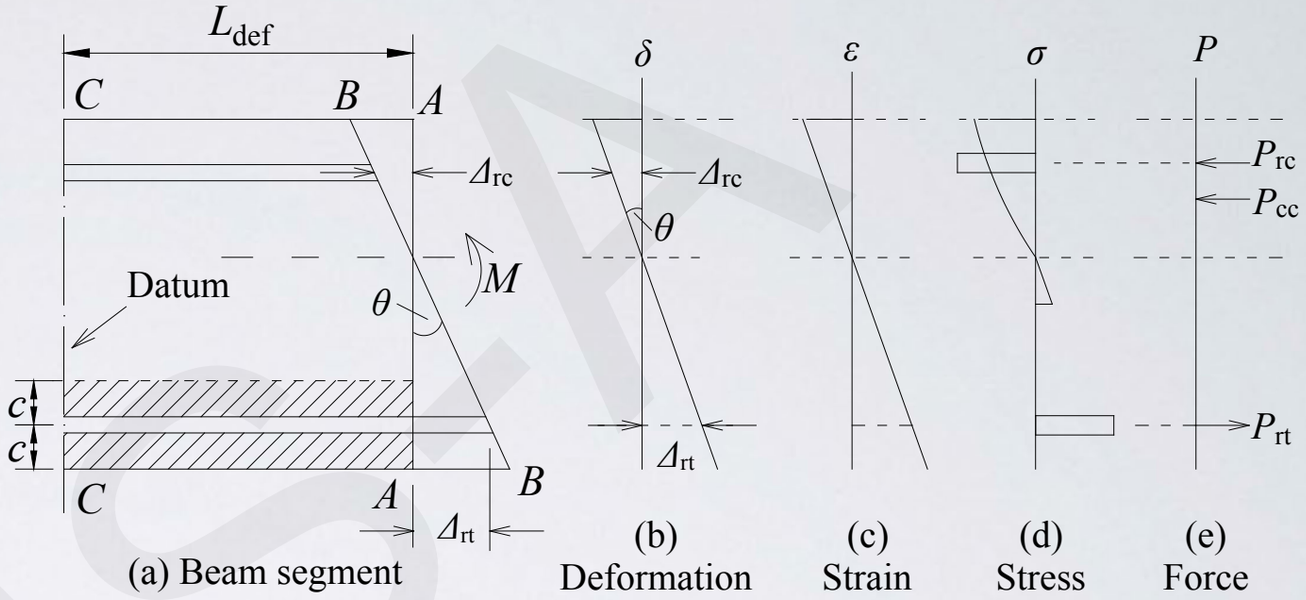


Figure 1. Segmental approach

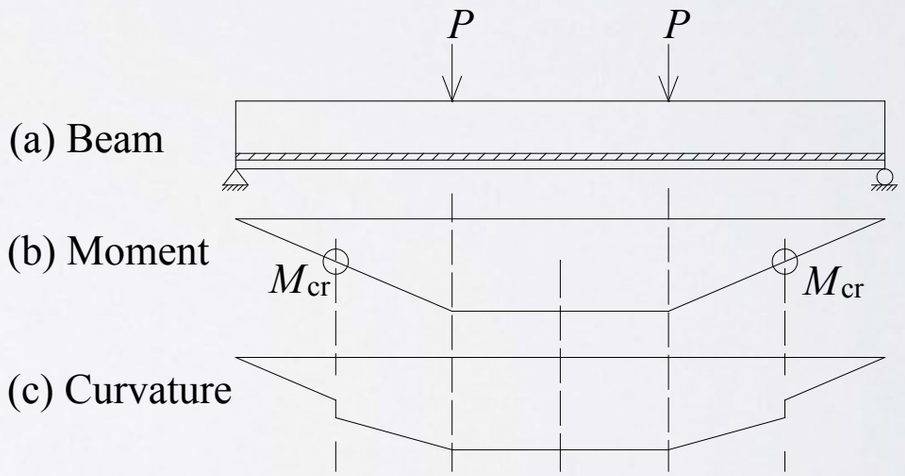


Figure 2. Standard analytical technique to get deflection distribution

Conclusions and Outlooks

Conclusions:

- The segmental approach allows for tension stiffening
- Corrosion changes the bond-slip properties and thus changes the load-deflection responses
- The segmental approach could be used to predict the corrosion level based on the provided load-deflection curves.

Outlooks:

- Study of confinement effect provided by stirrups on load-deflection relationship
- Study of time-dependent effects including creep, shrinkage and temperature on load-deflection relationship
- Analysis of crack width development due to corrosion and time-dependent effects.