A UNIFIED SHEAR – PUNCHING MECHANICAL MODEL FOR DESIGN AND ASSESSMENT OF STRUCTURAL CONCRETE MEMBERS

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SUMMARY

ABSTRACT

For daily engineering practice, simple but accurate models are needed for designing new structures or assessing existing structures in a safe, reliable, economical and easy way. Mechanical models are especially adequate for design purposes since they provide an insight into the structure behavior, incorporate the most relevant parameters involved and can be extended in a natural way to incorporate new technical advances.

In this presentation a mechanical model for shear strength of reinforced and prestressed concrete beams and one-way slabs, with and without stirrups is presented. The model developed, called Multi-Action Shear Model (MASM), incorporates the shear transferred by the concrete compression chord (V_{cc}), by aggregate interlock along the critical shear crack (V_{cw}), by dowel action in the longitudinal reinforcement (V_{cl}) and by the transverse reinforcement (V_s). The theoretical bases are presented as well as the simplifications made to derive a simpler, but accurate, design model called Compression Chord Capacity Model (CCCM).

The model has been extended to slender beams with T section shape, deep beams, beams subjected to point loads near the supports or to fatigue loading, FRP reinforced concrete beams with and without stirrups and to SFRC beams. Furthermore, the shear model has been extended to punching of RC slabs with and without transverse reinforcement. The model has been verified by comparing its predictions with a large number of shear and punching tests results, most included in the recently ACI-DAfStb databases. Very good results have been obtained in all cases, resulting in lower scatter and better accuracy than current ACI, EC2 and MC2010 provisions. Some aspects not yet sufficiently well solved and future developments will be finally discussed.