Università degli Studi di Pavia
Computational Mechanics & Advanced Materials Group - DICAr

SEMINAR

Mixed Formulation for Frame Elements with Singular Response and Bond-Slip

Structural engineers are increasingly interested in understanding how structures fail locally, and how these local failures affect structural global performance under seismic loading. Known for their high efficiency and accuracy in determining structural global response, frame elements, aka beam-column elements, are frequently used for large-scale structural simulation. Frame elements with mixed formulations are particularly more welcome than those with displacement formulations because the former offers better accuracy and efficiency in obtaining member responses. However, the element state determination for the former involves matrix inversion of section stiffness, and will breakdown in the presence of ill-conditioned or even singular section stiffness. This seminar will introduce how this numerical issue can be resolved via a carefully designed algorithm. It also discuss how the mixed formulations can be extended with additional fields to model members with bond-slip between components, while still attaining high computational efficiencies for large-scale structural simulation. The new formulation also generates member response information such as fixed-end rotation that is useful for performance-based earthquake engineering design. It applies to steel and reinforced concrete beams and columns, steel-concrete composite beams, as well as structural members with FRP reinforcements.

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