11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

MIXED FORMULATION FOR MODELLING SELF-CENTRING POST-TENSIONED ROCKING BEAMS AND COLUMNS

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Key Words: *Mixed Formulation, Exact Force Interpolation, Rocking Beam, Rocking Column, Self-Centring, Post-Tensioned.*

In finite element modelling of beams and columns, mixed formulation with exact interpolation of force distribution inside the element has been shown to offer significant advantages over most other traditional displacement formulations in terms of accuracy, efficiency and robustness [1-3]. In recent studies, this formulation has been extended to incorporate the effects of energy release via the interface relative slip between constituent components in composite beams and reinforced concrete columns [4-6]. This extended mixed formulation has shown great potential in accurately predicting not only global force-displacement response, but also local stress-strain response.

In this study this mixed formulation will be extended further to incorporate the effects of allowing fixed-end rotations and crack-openings within one component of the composite element while maintaining the displacement continuity of other components. This new mixed formulation can be readily applied to model PRESSS (PREcast Seismic Structural System), which is built by joining prefabricated beams and columns with unbonded post-tensioning tendons and with or without energy dissipating devices at the joints [7-9]. The response of such structural system is usually characterized by self-centring "flag-shape" hysteresis loops with rocking motions at the joints.

The advantages of this newly extended mixed formulation will be demonstrated by comparing numerical results and experimental results of a post-tensioned timber column undergone a series of bi-axial loadings [10-11].

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