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FINITE ELEMENT MODELLING OF COMPRESSIVE AND TENSILE PRESTRESSED TUBULAR MEMBERS

Michaela Gkantou[1], Marios Theofanous[1] and Charalampos Baniotopoulos[1]

[1]School of Engineering (Department of Civil Engineering, University of Birmingham, Edgbaston B15 2TT, UK)
e-mail: m.gkantou@bham.ac.uk

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ABSTRACT

The current paper discusses the simulation of the structural behaviour of prestressed tubular members in steel grade S460 and S690, through the execution of advanced numerical modelling. Numerical models are validated against published experimental data [1], in which different initial prestress levels and the presence of grouting has been examined for high strength steel compressive and tensile members. In order to accurately replicate the experimental response through finite element modelling, certain parameters oblige careful consideration. The selected numerical solver, the material models and the element types are therefore thoroughly described in the present paper. Upon establishment of the numerical models, the numerically generated ultimate loads, failure modes and the full load-deformation curves are compared with the experimental ones, indicating a successful validation. For the compressive members, an imperfection study is executed in order to investigate the influence of the initial geometric imperfections on the overall structural performance, showing that an imperfection magnitude of L/1000 predicts sufficiently the experimental behavior. Evaluating both the experimental and the numerical results, it is concluded that, as anticipated, prestressing enhances the load-bearing capacity for tensile members, whilst is detrimental for compressive members.

REFERENCES

[1] Wang, J., Afshan, S. and Gardner, L. (2016) "Axial behaviour of prestressed high strength steel tubular members" *Proceedings of the international colloquium on stability and ductility of steel structures – SDSS 2016*, 30 May – 01 June 2016, Timisoara, Romania