Michaela Gkantou
Doctoral researcher in structural engineering
PhD subject: Numerical investigation of the structural response of High Strength Steel
Email: mxg375@bham.ac.uk
Supervisors: Prof. Charalampos Baniotopoulos - c.baniotopoulos@bham.ac.uk
Dr. Marios Theofanous - m.theofanous@bham.ac.uk
Dr. Hassan Hemida - h.hemida@bham.ac.uk

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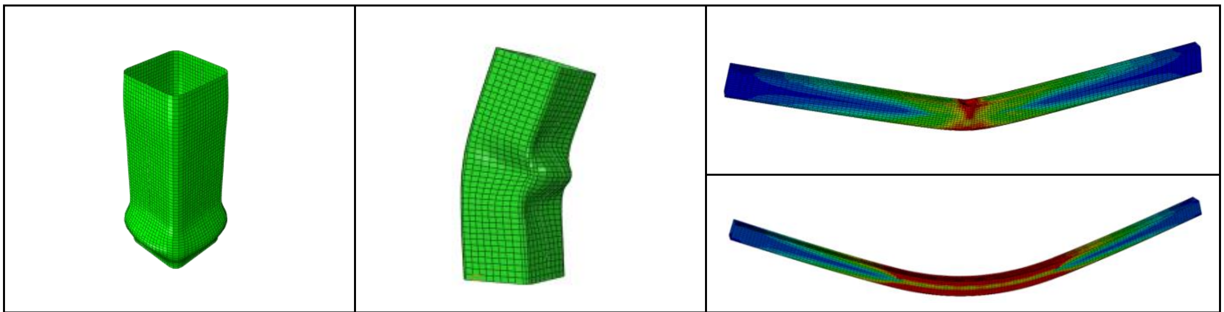
Research Background:
Technological advances in material science and production methods together with increasing demand for light and sustainable structures introduced high strength steel (HSS) into the construction market over the last decades. HSS's main benefit is its high yield stress, which potentially leads to smaller cross-section sizes and hence to lighter structures. A lighter structure, apart from being aesthetically more elegant and iconic, implies smaller member sizes and foundations which in turn lead -both directly in less material used and indirectly in lower transportation workloads - to lower CO2 emissions and energy use. However, smaller section sizes lead to more slender structures, for which serviceability and buckling considerations are more likely to govern the design. This drawback can be outweighed with the use of post-tensioning, which allows minimum material consumption by storing energy under increasing preload.

Research aim and objectives:
Aim
- To investigate the structural response of high strength steel under various load configurations, thus contributing to the research on the response of high strength steel members and structures (prestressed or non-prestressed)

Objectives
- Investigate the behaviour of HSS bending beams under 3-point and 4-point bending, for varying cross-sectional aspect ratio, steel grade and cross section slenderness
- Study the cross-sectional response of HSS stub columns under concentric and eccentric loading, for varying steel grade, cross section slenderness and load eccentricities
- Examine the structural behaviour of HSS prestressed truss elements (i.e. members under tension and compression)
- Study the response of HSS prestressed trusses for varying prestress levels, steel grade and type of grouting

Methodology
In order to determine the structural response of HSS members and structures, the general purpose finite element (FE) package ABAQUS is utilized. The developed FE models are validated against the experimental data of HILONG project before the execution of the parametric studies. Both linear (Eigenbuckling) and non-linear (Riks) static analysis are performed, whilst geometric imperfections are properly considered. After the discussion of the results, Eurocode design specifications are assessed.



concentric stub column (elephant foot failure mode)	*eccentric stub column*	*3-point and 4-point bending beams*

First numerical results: Typical failure modes of HSS models under various loading scenarios