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Bending Tests for the Axial Load Identifications in Space Structures with Unknown Boundary Conditions

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Abstract : This paper presents the extension of a static method for the axial load identifications in prismatic beam-columns with uncertain length and unknown boundary conditions belonging to generic space structures, such as columns of space frames or struts and ties of space trusses. The non-destructive method requires the knowledge of the beam-column flexural rigidity only. Flexural displacements are measured at five cross sections along the beam-column subjected to an additional vertical load at the mid-span. Unlike analogous dynamic methods, any set of experimental data may be used in the identification procedure. The method is verified by means of many numerical and experimental tests on beam-columns having unknown boundary conditions and different slenderness belonging to three different space prototypes in small-scale. Excellent estimates of the tensile and compressive forces are obtained for the elements with higher slenderness and when the greatest possible distance between sensors is adopted. Moreover, the application of larger values of the vertical load and very accurate displacement measurements are required. The method could be an efficacious technique in-situ, considering that safety inspections will become increasingly important in the near future, especially because of the improvement of the material properties that allowed designing space structures composed of beam-columns with higher slenderness.

Keywords : force identification, in-situ test, space structure, static test
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