SM22S_12669

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

The Stiffness of Prestressed Frameworks: A Unifying Approach

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Three different methods are commonly used to analyse the stiffness of prestressed frameworks that consist of bars and spherical joints. This paper will show that in fact the correct tangent stiffness matrix for a prestressed structure, as used in the computational literature, can be written as the sum of two terms. The first is a minor modification of a conventional stiffness matrix, that is best understood in terms of the equilibrium matrix that has been widely studied in the engineering mechanics literature. The second term is the stress matrix, that has been widely studied in the mathematical rigidity theory literature. Thus the extensive, but mutually exclusive, literature in these two areas is shown to be complimentary – giving useful insight into the response of prestressed frameworks; in combination, the two approaches can reproduce the complete, but less intuitive, results from the computational literature

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