

A simplified procedure to calculate by hand the natural periods of semi-rigid steel frames

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ABSTRACT: Natural frequency for any structure can be found by finite element packages such as ABAQUS. However, the computational cost and time are too large for routine design work. Currently, the seismic design codes provide equations which relate the fundamental period to the height of the frame and do not take into account the effect of semi-rigid connections. The proposed approximate formulae have been developed after modifications of existing formulae in literature for the rigid plane steel frames.

The procedure is for symmetrical in plan steel braced or unbraced frames which have uniform properties along its height. The steel frame is modelled as equivalent shear-flexure cantilever beam for which the solution for the free vibration periods is available. Then, the accuracy of this simplified procedure has been validated by the finite element analysis of plane steel frames with semi-rigid connections using ABAQUS software. Finally, a parametric study has been conducted to quantify the effects of semi-rigid connections on the natural frequencies (i.e. inverse periods) of vibration of plane steel frames.

CE Database subject headings: Steel frames; Connections, semi-rigid; Natural frequency; Flexibility; Seismic analysis