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Torsional analysis of multi-storey building structures under horizontal load

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SUMMARY

New closed-form formulae are presented for the torsional analysis of asymmetrical multi-storey buildings braced by moment-resisting (and/or braced) frames, (coupled) shear walls and cores. The analysis is based on an analogy between the bending and torsion of structural systems. A closed-form solution is presented for the rotation of the building. The torsional behaviour is defined by three distinctive phenomena: warping torsion, Saint-Venant torsion and the interaction between the two basic modes. Accordingly, the formula for the maximum rotation of the building consists of three parts: the warping rotation is characterized by the warping stiffness of the bracing system, St Venant rotation is associated with the St Venant stiffness of the building and the third part is responsible for the interaction. It is demonstrated that the interaction between the warping and St Venant modes is always beneficial, as it reduces the rotation of the structure. It is shown how the proposed formula for torsion can be used for the determination of the maximum deflection of multi-storey asymmetrical building structures. The results of a comprehensive accuracy analysis demonstrate the validity of the method. A worked example is given to show the ease of use of the procedure. Copyright © 2010 John Wiley & Sons, Ltd.