RIGID JOINTED STRUCTURES

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Abstract

Owing to the unloading characteristics of short compression members which reach a maximum load corresponding to the attainment of the yield stress over the full cross-section, plastic theory cannot be used for the rational design of trusses. On the basis of a theoretical study using an elastic-plastic stress-strain law, it is concluded that such behaviour is found in even the shortest struts, but a limited plastic action under reduced load is predicted for a special cases. Experiment shows that the characteristics is favourably modified in these cases, and that the strain-hardening which results from the high curvatures in very short buckled members also raises the characteristic, but a true plastic response is not attained.

The organisation of the analysis of the general framework is discussed, elastic moment distribution sway analysis for polygonal frames is generalised, and the rigid-plastic analysis of triangulated frames is developed. It is concluded that, at the maximum load, axial plastic strains which have occurred during the unwrapping of short compression members originally in double curvature could produce only an insignificant increase in shortening relative to the initial single curvature case. Experiments with triangles designed to show up any such distinction show similar behaviour for both cases after the maximum load has been reached. Since the shortening characteristics for short members governed by strain-hardening and the yield condition is found to be plastic up to deformations which would be regarded as unserviceable in practice, there is some prospect of plastic design.