Abstract

In a laboratory investigation, twelve columns made of high strength steel with different webs and flanges were subjected to cyclic axial load in a normal environment. The cyclic load was of constant range, maximum web load of which exceeded the critical buckling strength of the web. The test results showed that the mode of failure was that cracks initiated in the weld toe of the flanges and propagated along the weld; thus separating web and flanges and lowering the critical load of the column. When the cracks reached a certain length, local buckling failure of this unrestrained flange occurred.

On the basis of the fact that cracks were always initiated in the weld toe of the flanges, a formula was derived to calculate the stress in the places most likely for crack initiation along the weld. The data points, that are the intersections of cycle numbers to initiating cracks and the stress ranges, are compared with the fatigue strength curve in Swedish regulations for steel structures. (BSK) The numbers of cycles to initiating cracks are obtained from the tests, and the stress ranges are obtained by the derived formula. Although the points are somewhat scattered, they fit with the fatigue strength curve. Hence, the foregoing formula can be used to calculate the fatigue life of H or rectangular box section columns, whose web is in the post-buckling stage.