

THEORETICAL PROCEDURE TO PREDICT THE LOCAL BUCKLING RESISTANCE OF ALUMINIUM MEMBERS IN ELASTIC-PLASTIC RANGE

Vincenzo Piluso¹ and Alessandro Pisapia²

¹ University of Salerno, Via Giovanni Paolo II, 132-84084 Fisciano (SA), v.piluso@unisa.it

² University of Salerno, Via Giovanni Paolo II, 132-84084 Fisciano (SA), alpisapia@unisa.it

Key Words: *Local buckling, Deformation theory of plasticity, aluminium alloys*

In the present research work, a theoretical approach to evaluate the ultimate resistance of aluminium alloy members subjected to local buckling under uniform compression is provided. In particular, starting from the J_2 deformation theory of plasticity, the theory of plastic buckling of plates has been extended including the variability of the Poisson's ratio depending on the stress levels. The differential equation of the plates at the onset of buckling is developed and the corresponding solution is determined. This derivation represents an innovative step compared to the theoretical solutions currently existing in the technical literature because the variability of the Poisson's ratio in the elastic-plastic region is commonly not accounted.

Subsequently, starting from the obtained closed-form solution, the interactive buckling either in the elastic or in the plastic range of a generic aluminium members in compression is analysed. In particular, two types of cross-sections are analysed: box and channel shaped members. To this scope, the Levy solution of the differential equation of a single plate in elastic-plastic range is applied to the assembled plates constituting the cross-sections.

Obviously, the interaction between the plate elements constituting the section is explicitly accounted by means of the boundary conditions accounting for restraining action. The previous boundary conditions lead to a system of equations whose trivial solution corresponds to the member in its non-deformed configuration. The prediction of the critical stress corresponding to local buckling in the elastic-plastic region is obtained as the value corresponding to the existence of a non-trivial solution for which the determinant of the matrix of the equation system is equal to zero. Finally, in order to consider the geometric imperfections of aluminium members, the procedure has been repeated by considering different geometric properties of plates composing the analysed cross-sections.