Submission of Papers

10th Eurosteel, Amsterdam 2023

Title:

Characterisation of the full non-linear behaviour up to failure of the sheared panel zone in welded steel beam-to-column joints

Abstract:

Nowadays, the Eurocodes require from the civil engineer to ensure an appropriate level of robustness to any structure. In steel and steel-concrete composite structures, this request for robustness leads to specific requests at the level of the joints between the structural members, these joints being the weak elements at the beam extremities when they are partial strength ones. In particular, to meet these specific requests, it is recommended to provide an appropriate ductility to the joints that would allow them to "survive to the shock" in the case of an unforeseen exceptional event (impact, fire, explosion, earthquake…).

However, the component method, as it is currently prescribed in the Part 1-8 of Eurocode 3 (EN 1993-1-8) allows characterising a joint in terms of initial rotational stiffness and plastic bending moment resistance, but it does not provide any expression for the prediction of the rotation capacity of the joint.

In this context, a research project was launched at the University of Liège with the aim of extending the component method towards the large deformation field and under complex loading conditions. The present paper focuses on the behaviour of the panel zone (PZ), which is known to provide a significant reserve of ductility to the joint, when it is activated and appropriately designed. More precisely, it proposes a new advanced constitutive model for the prediction of the full non-linear behaviour of this component up to failure.

This model has been developed in the context of simple welded joints under monotonic loading conditions only. The finite element (FE) approach was used to identify the key parameters governing the deformability and the failure of the PZ. The resulting full-range model, encompassing those key parameters, was extensively validated against numerical and experimental results, where it proved to predict the PZ ultimate resistance and ultimate deformation capacity with reasonable accuracy.

Authors:

Adrien CORMAN, adrien.corman@uliege.be

Jean-Pierre JASPART, jean-pierre.jaspart@uliege.be

Jean-François DEMONCEAU, jfdemonceau@uliege.be

Corresponding Author:

Adrien CORMAN, adrien.corman@uliege.be