

Abstract

The present paper describes a coupled pair of special elastic Trefftz elements representing an entire spotweld for the application in explicit finite element programs (Crash). The linking to the residual finite element mesh, consisting of standard shells, is accomplished via a displacement frame, an arbitrary polygon. Elimination of all internal variables yields a stiffness matrix, which can be used directly in coupling with any other element with similar displacement assumptions on the interface. By definition the Trefftz-type solution satisfies a priori all governing differential equations within the element area, leading to a high resolution of the stress field in the vicinity of the spotweld, and thus enables the introduction of more accurate stress-based failure criteria. We assess the numerical stability of the spotweld element within the framework of explicit time integration using the central difference scheme and show some examples of its application.

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