

Elemental crack advance assessment and verification for its use in LBB analysis

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Abstract-

The leak before break (LBB) concept is today widely employed at the nuclear industry to preclude catastrophic rupture, mainly on pipes. This paper presents two complimentary procedures. Both of them are applied via the Finite Element Method, for demonstrating LBB on austenitic stainless steel vessels. Those procedures are submodeling and the Elemental Crack Advance method. One procedure verifies the results obtained using the other, making them robust and trustworthy. Those practices are illustrated on the ALFRED reactor using the software ANSYS. They are applicable to geometrical shapes for which simplified expressions of the J-integral are not available. This illustration, proves as well, that by means of small design modifications such as thickening the bottom head, LBB can be demonstrated in the ALFRED reactor. The submodeling technique stands as the main vehicle in the LBB demonstration exposed at this work. The Elemental Crack Advance method lies as a tool for verifying a wide variety of Fracture Mechanics assessment, including non-LBB related ones.

Index Terms- ALFRED; Leak before break; Crack; FEM; ANSYS; Fracture mechanics, Elemental crack advance; J-integral; Plastic instability

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