Numerical Analysis of the Influence of Corrosion on the Cracked Pressure Pipe using XFEM Castem

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Abstract:

The purpose of the study is to assess how dangerous corrosion flaws in pressurized pipelines are. The ASME code's semi-empirical techniques were used, and they were verified by numerical computations with CASTEM software. The Stress Intensity Factor (SIF) for elastic behavior analysis was calculated using the Extended Finite Element Method (XFEM). The primary objective is to assess the influence of the corroded area on the severity of defects in pressurized pipes. Within the XFEM framework, the corrosion defect is represented using level set functions. The variation in the Stress Intensity Factor is analyzed as a function of pipe thickness and corroded surface area. For P265GH steel whose fracture toughness is low (the critical stress intensity factor is less than 90 MPa$\sqrt{m}$). The results of the study show that corroded pressure pipes have sufficient toughness to admit defects relatively deep. These results are promising prospects for exploiting the possibilities of numerical simulation in the evaluation of ultimate loads under combined axial force and internal pressure loadings in pipelines.

Keywords:

Pressurized pipes, corrosion, level set, XFEM, CASTEM code, P265GH steel.