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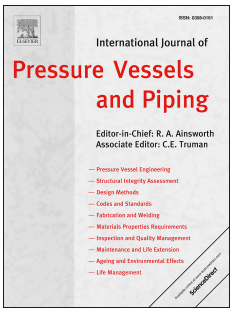

Complex Finite Element Sensitivity Method for Creep Analysis

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Complex Finite Element Sensitivity Method for Creep Analysis

Armando Gomez-Farias[1], Arturo Montoya[2], Harry Millwater[3]

Abstract

The complex finite element method (ZFEM) has been extended to perform sensitivity analysis for mechanical and structural systems undergoing creep deformation. ZFEM uses a complex finite element formulation to provide shape, material, and loading derivatives of the system response, providing an insight into the essential factors which control the behavior of the system as a function of time. A complex variable-based quadrilateral user element (UEL) subroutine implementing the power law creep constitutive formulation was incorporated within the Abaqus commercial finite element software. The results of the complex finite element computations were verified by comparing them to the reference solution for the steady-state creep problem of a thick-walled cylinder in the power law creep range. A practical application of the ZFEM implementation to creep deformation analysis is the calculation of the skeletal point of a notched bar test from a single ZFEM run. In contrast, the standard finite element procedure requires multiple runs. The value of the skeletal point is that it identifies the location where the stress state is accurate, regardless of the certainty of the creep material properties.

Keywords: creep, sensitivity analysis, pressure vessel, skeletal point, complex step method

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