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Evaluating the Fire Resistance of Offshore Tubular K-Joints Subjected to Balanced Axial Loads

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Abstract : Results of 405 finite element (FE) analyses were used in the present research to study the effect of the joint geometry on the ultimate strength and initial stiffness of tubular K-joints subjected to axial loading at fire-induced elevated temperatures. The FE models were validated against the data available from experimental tests. Structural behavior under different temperatures (200ºC, 400ºC, 500ºC, and 700ºC) was investigated and compared to the behavior at ambient temperature (20ºC). A parametric study was conducted to investigate the effect of dimensionless geometrical parameters (β, γ, θ, and τ) on the ultimate strength and initial stiffness. Afterwards, ultimate strength data extracted from the FE analyses were compared with the values calculated from the equations proposed by available design codes in which the ultimate strength of the joint at elevated temperatures is obtained by replacing the yield stress of the steel at ambient temperature with the corresponding value at elevated temperature. It was indicated that this method may not have acceptable accuracy for K-joints under axial loading. Hence, a design formula was developed, through nonlinear regression analyses, to determine the ultimate strength of K-joints subjected to balanced axial loads at elevated temperatures.

Keywords : axial loading, elevated temperature, parametric equation, static strength, tubular K-joint
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