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Research on burst pressure for thin-walled elbow and spherical shell made of strength differential materials

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Abstract

This paper derived the computational formulae of burst pressure for thin-walled elbows and thin-walled spherical shells with arbitrary curvatures, using the finite deformation theory and the unified strength theory, and considering the intermediate principal stress, the strength disparity effect of materials and the strain-hardening effect. The quantitative relationship between the burst pressure of thin-walled elbows and thin-walled spherical shells was obtained as well. Additionally, this study analysed how the strain-hardening index, the thickness/radius ratio, the curvatures of elbows, the strength disparity effect of materials and the intermediate principal stress affected the burst pressure of thin-walled elbows and thin-walled spherical shells and the burst pressure ratio. The deduced formulae provide the solution for burst pressure with

different yield criteria, which is of wide applications and guidance for security design and integrity assessment of thin-walled pressure vessels.

Keywords:

Unified strength theory | Thin-walled elbow | Thin-walled spherical shell | Burst pressure | SD effect | Intermediate principal stress

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