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TO: Khalil Farhangdoost

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Sincerely yours,

Arturs Kalnins  
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# Analysis of Fatigue ASME Codes for Pressure Vessels

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## Abstract

In industries, pressure vessels or in general thick-wall cylinders under internal pressure are important parts and analyze of their applications in various condition is essential. Therefore, for design and maintenance of pressure vessels usage of standard codes like ASME is necessary.

Most of cracked or damaged pressure vessels are exposed to cyclic loading. This failure process is fatigue. ASME standard has some codes for analyzing this process. This codes show the conditions and formulas for fatigue analyze.

In this paper, a thick wall pressure vessel with three cyclic loading conditions is analyzed by ASME codes and maximum stress intensity, fatigue life and damage factor are calculated. Then by usage of finite element method, ASME results are compared. For fatigue life analyze by finite element, ANSYS WORKBENCH software is used.

Previous investigations show that nozzle connection of pressure vessels has high stress concentration and crack growing start from this zone. Thus fatigue analyze is accomplished for nozzle connection of pressure vessel by ASME codes and finite element method.

Then nine shape of crack with same crack front size are modeled on the maximum stress zone of the nozzle connection. Then stresses of crack fronts and stress intensity factors of cracks are computed by finite element method with ABAQUS software which is powerful for fracture mechanic analyses.

The critical crack which is elliptical prismatic crack virtually is grown step by step and for each step, stress intensity factor is computed by ABAQUS. With relation between stress intensity factor and crack size also using Paris formula, fatigue life is computed. This operation is done for two type of crack growing. In first type length and depth of crack are grown and in second type only crack length is grown. Finally, the fatigue life obtained from Paris formula and ASME codes are compared.

Keywords: ASME codes- fatigue- finite element method- nozzle- stress intensity factor- Paris formula