



The Effects of Uniform, Partial and Gradient Thermal Loadings on Cylindrical Steel Reservoirs using Finite Elements Approach

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ABSTRACT:

Circular reservoirs are used in oil, water and wheat grains storage systems extensively. Beside the hydrostatic pressure and seismic load, thermal load is one of the important loads in design procedure of cylindrical reservoirs. Usually, thermal load is applied as a uniform load on wall and roof but in some design codes it is mentioned to apply the effects of gradient thermal load due to angle variation of sunshine through a days and seasons in Analysis and design approach. In this paper by using finite element modeling of cylindrical steel reservoirs, two types of thermal load such as constant, gradient as a function of radius-angle have been applied and induced displacements and stresses are investigated respectively. In order to evaluate aforementioned parameters, different models with various ratios of height to diameter selected and for all models the reservoirs volume is assumed to be constant. All consequences and results are discussed and displayed in separate graphs.

Key Words: circular steel reservoirs, finite element modeling, gradient thermal loading, radius- angle.

1. INTRODUCTION

Circular reservoirs are extensively applied for storing liquids such as oil, water and wheat grains, etc. Usually these reservoirs are constructed from concrete or steel material and in circular or cubic forms. As interesting geometrical shape and wide application of cylindrical reservoirs, most of researches on the storing reservoirs have been focused on this form. In the field of effects of hydrostatic and seismic loads on reservoirs, numerous investigations have been performed in previous researches [1-4] and their results are rebounded in design codes [5-8].

Thermal loading defined in the form of temperature loading (ΔT) is one of the important loading types behind hydrostatic, soil pressure and seismic loads which is pointed out in building codes [5-8]. In circular reservoirs same other radial symmetric structures, in addition to uniform thermal loading, gradient thermal loading on wall-as a function of varying sunshine angle during day and various seasons is one of the important loading type in design of these reservoirs which the level of importance is pointed out in some design codes [1-2].

In this research, finite element modeling of cylindrical steel reservoirs with various height to diameter ratios (H/D) with a constant volume of reservoir, is carried out and hydrostatic pressure and thermal loads in the forms of uniform and gradient are