Load case - WCST

Oliasoft

Abstract

In this document we describe the load case *WCST* available in the Oliasoft™ application.

Introduction

The well containment screening tool WCST is a collapse load case, where the unknown is the internal pressure profile of the tubing[1].

Inputs The following inputs define the WCST load case

1) The true vertical depth (TVD) along the wellbore as a function of measured depth. Alternatively, the wellbore described by a set of survey stations, with complete information about measured depth and inclination.
2) The true vertical depth/TVD of
   a) The hanger of the tubing, $\text{TVD}_{\text{hanger}}$.
   b) The shoe of the tubing, TVD_{shoe}.
   c) The mean sea level, TVD_{MSL}.
   d) The mudline, $\text{TVD}_{\text{mudline}}$.
3) The temperature profile of the wellbore, T.
4) The density of seawater, ρ_{sw}.
5) The gas/oil gradient, ρ_{g}, or gas specific gravity, sg_{gas}.
6) The gravitational constant, g.

Calculations If the hanger of the tubing is above mean sea level (MSL), then from the hanger to MSL

$$P_i = 0, \qquad \text{gauge pressure} \tag{1}$$

and from MSL to the mudline

$$P_i = g\rho_{\text{sw}}\,(\text{TVD} - \text{TVD}_{\text{MSL}}), \qquad \text{TVD} \in [\text{TVD}_{\text{MSL}}, \text{TVD}_{\text{mudline}}] \tag{2}$$

If gas specific gravity is entered, sg_{gas}, a gas gradient, ρ_{g}, is calculated using z-factor and Sutton correlations [1], using the temperature and pressure at the mudline as input. The gas density is used to calculate pressure at the shoe as

$$P_{\text{shoe}} = P_{\text{mudline}} + g\rho_{\text{g}}\,(\text{TVD}_{\text{shoe}} - \text{TVD}_{\text{mudline}}), \tag{3}$$

where

$$P_{\text{mudline}} = g\rho_{\text{sw}}\,(\text{TVD}_{\text{mudline}} - \text{TVD}_{\text{MSL}}). \tag{4}$$

The internal pressure from mudline to shoe is the affine profile in TVD based on P_{mudline} and P_{shoe}.

[1] We denote any tubular by tubing. All calculations encompass both tubings and casings.

External profile The external pressure profile for this load case is given by the hydrostatic pressure based on the fracture gradient at the previous shoe and mud at shoe, from hanger to top of cement, and pore pressure in cement.

References

[1] Curtis H. Whitson and Michael R. Brulé. *Phase behavior*, volume 20 of *Henry L. Doherty series*. SPE Monograph series, 2000.