Load case - negative pressure test

Oliasoft

Abstract

In this document we describe the load case *Negative pressure test* available in the Oliasoft™ application.

Introduction

Negative pressure test is a collapse load case, where the unknown is the internal pressure profile of the tubing[1]. The pressure profile consists of the hydrostatic salt water pressure to l meters below the mud line, , plus an additional pressure drop, and the hydrostatic mud pressure below.

Inputs The following inputs define the negative pressure test 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, inclination, and azimuth.
2) The true vertical depth/TVD of
   a) The rig RKB, TVD_{RKB}.
   b) The wellhead/BOP interface, $\text{TVD}_{\text{WH/BOP}}$.
   c) The TVD from rotary table to mud line, $\text{TVD}_{\text{RT to ML}}$.
   d) The hanger of the tubing, $\text{TVD}_{\text{hanger}}$.
   e) The shoe of the tubing, TVD_{shoe}.
3) Length below mud line to use seawater gradient, l_m, default is $l_m = 1000$ ft ($\simeq 300$ m)
4) Pressure drop, p_n, default to $p_n = 500$ psi ($\simeq 3.4$ MPa)
5) The mud weight/density, ρ_m.
6) The salt water density, ρ_{sw}.

Calculations The internal pressure profile, parametrized by TVD, of the tubing is then given by

$$p_i = \begin{cases} \rho_{sw}\, g\, \text{TVD} - p_n, & \text{TVD} \leq \text{TVD}_{\text{RT to ML}} + l_m, \\ p_{\text{ml+l}_m} + \rho_m\, g\, (\text{TVD} - (\text{TVD}_{\text{RT to ML}} + l_m)), & \text{else}, \end{cases} \tag{1}$$

where g is the gravitational constant, and $p_{\text{ml+l}_m}$ is the hydrostatic salt water pressure at the wellhead plus l_m including the pressure drop, i.e.

$$p_{\text{ml+l}_m} = \rho_{sw}\, g\, (\text{TVD}_{\text{RT to ML}} + l_m) - p_n. \tag{2}$$

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