Load case - gas migration$_C$

Oliasoft

Abstract

In this document we describe the load case *Gas migration$_C$* available in the Oliasoft™ application.

Introduction

Gas migration$_C$ is a collapse load case, where the unknown is the pressure profile of the tubing[1].

Inputs The following inputs define the gas migration 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 shoe of the prior tubing, $\text{TVD}_{\text{prior shoe}}$.
3) The temperature profile of the wellbore, T.
4) The packer fluid density, ρ_{pf}.
5) The reservoir pressure, P_{res}.
6) The fracture pressure at prior shoe, $P_{\text{f@ps}}$.
7) The mud weight/density, ρ_{mud}.
8) The gravitational constant, g.
9) Whether or not to limit the external pressure at prior shoe by the fracture pressure there.

Calculations The internal pressure profile is simply the hydrostatic pressure from the packer fluid, i.e.

$$P_i = g\rho_{\text{pf}}\text{TVD}, \qquad \text{TVD} \in [\text{TVD}_{\text{hanger}}, \text{TVD}_{\text{shoe}}]. \tag{1}$$

It is assumed that the external pressure at the wellhead/hanger is equal to the reservoir pressure, P_{res}. By this assumption and the mud weight, it follows that the pressure at the prior shoe, P_{ps}, is

$$P_{\text{ps}} = P_{\text{res}} + g\rho_{\text{mud}}\left(\text{TVD}_{\text{prior shoe}} - \text{TVD}_{\text{hanger}}\right). \tag{2}$$

If the *limit the external pressure at prior shoe* is enabled, and $P_{\text{ps}} > P_{\text{f@ps}}$, then the external pressure is given by

$$P_e = P_{\text{f@ps}} - g\rho_{\text{mud}}\left(\text{TVD}_{\text{prior shoe}} - \text{TVD}\right), \qquad \text{TVD} \in [\text{TVD}_{\text{hanger}}, \text{TVD}_{\text{shoe}}], \tag{3}$$

else it is given by

$$P_e = P_{\text{res}} + g\rho_{\text{mud}}\left(\text{TVD} - \text{TVD}_{\text{hanger}}\right), \qquad \text{TVD} \in [\text{TVD}_{\text{hanger}}, \text{TVD}_{\text{shoe}}]. \tag{4}$$

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