

Load case - lost returns with water

Oliasoft

Abstract

In this document we describe the load case *Lost returns with water* available in the Oliasoft™ application.

Introduction

Lost returns with water is a burst load case, where the unknown is the internal pressure profile of the tubing¹. This load case reflects that water is pumped from the surface down the tubing due to lost returns, and the pressure profile is given by the hydrostatic pressure from the fracture pressure at the shoe.

Inputs The following inputs define the lost returns with water 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 hanger of the tubing, TVD_{hanger} .
 - b) The shoe of the tubing, TVD_{shoe} .
 - c) The mud-water interface, TVD_{MW} .
- 3) The fracture pressure profile from hanger to shoe.
- 4) The mud weight/density, ρ_{mud} .
- 5) The density of water, with default value $\rho_{\text{water}} = 998 \text{ kg/m}^3$.
- 6) A fracture margin of error, added to the fracture pressure.

Calculations The internal pressure profile of the tubing is calculated as follows

- 1) Calculate the fracture pressure at the shoe, $p_{f, \text{shoe}}$.
- 2) Calculate the hydrostatic pressure from shoe to hanger, taking the mud-water interface into account. Explicitly, if the mud-water interface is below the shoe, i.e. $TVD_{\text{MW}} \geq TVD_{\text{shoe}}$, then the internal pressure in the tubing, parametrized by TVD, is given by

$$p_i = p_{f, \text{shoe}} - \rho_{\text{water}} g (TVD_{\text{shoe}} - TVD). \quad (1)$$

where g is the gravitational constant. If, on the other hand, the mud-water interface is between the hanger and the shoe, i.e. $TVD_{\text{hanger}} \leq TVD_{\text{MW}} < TVD_{\text{shoe}}$, then calculate the pressure at the mud-water interface

$$p_{\text{MW}} = p_{f, \text{shoe}} - \rho_{\text{mud}} g (TVD_{\text{shoe}} - TVD_{\text{MW}}), \quad (2)$$

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

and the internal pressure in the tubing is

$$p_i = \begin{cases} p_{MW} - \rho_{\text{water}} g (\text{TVD}_{MW} - \text{TVD}), & \text{TVD} \leq \text{TVD}_{MW}, \\ p_{f, \text{shoe}} - \rho_{\text{mud}} g (\text{TVD}_{\text{shoe}} - \text{TVD}), & \text{else.} \end{cases} \quad (3)$$