Load case - hydrostatic isolation

Oliasoft

Abstract

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

Introduction

Hydrostatic isolation is a collapse load case, where the unknown is the external pressure profile of the tubing[1]. The, so called, hydrostatic isolation depth (HID) is [usually] assumed to be the top of cement. The external pressure is found, by first identifying the fracture pressure at the previous shoe or weakest formation above HID, and then calculated as the hydrostatic pressure relative to this above HID, and the pore pressure below.

Inputs The following inputs define the hydrostatic isolation depth 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, $\mathrm{TVD}_{\mathrm{hanger}}$.
   b) The shoe of the tubing, $\mathrm{TVD}_{\mathrm{shoe}}$.
   c) The shoe of the previous tubing, if any, $\mathrm{TVD}_{\mathrm{prev.\ shoe}}$.
   d) The hydrostatic isolation depth, $\mathrm{TVD}_{\mathrm{HID}}$.
3) The pore- and fracture- pressure profile from hanger to shoe.
4) The mud weight/density, ρ_{mud}.
5) A fracture margin of error, ϵ_{frac} added to the fracture pressure.

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

1) If there is a prior shoe, calculate the fracture pressure there. If not, calculate the fracture pressure at the weakest formation (WF) in the open hole above HID. Denote this pressure by p_{frac}, and the corresponding depth by $\mathrm{TVD}_{\mathrm{wfd}}$.
2) Calculate the external pressure profile of the tubing in three steps, from hanger to prior shoe/WF, then from prior shoe/WF to HID and finally from HID to the shoe. Precisely,

$$p_e = \begin{cases} p_{\mathrm{frac}} - \rho_{\mathrm{mud}}\, g(\mathrm{TVD}_{\mathrm{wfd}} - \mathrm{TVD}), & \mathrm{TVD}_{\mathrm{hanger}} \leq \mathrm{TVD} \leq \mathrm{TVD}_{\mathrm{wfd}}, \\ p_{\mathrm{frac}} + \rho_{\mathrm{mud}}\, g(\mathrm{TVD} - \mathrm{TVD}_{\mathrm{wfd}}), & \mathrm{TVD}_{\mathrm{wfd}} < \mathrm{TVD} \leq \mathrm{TVD}_{\mathrm{HID}}, \\ p_{\mathrm{pore}}(\mathrm{TVD}), & \mathrm{TVD}_{\mathrm{HID}} < \mathrm{TVD} \leq \mathrm{TVD}_{\mathrm{shoe}}, \end{cases} \tag{1}$$

where $p_{\mathrm{pore}}(\mathrm{TVD})$ denotes the pore pressure at the TVD under consideration.

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