Static Vertical Pressure Variation @model

@wikipedia

Motivation

The pipeline and wellbore flow simulations require a model of static fluid pressure p variation as a function of elevation z:

(1) $$p = p(z)$$

Output

$p(z)$	Fluid pressure p

Input

z	Elevation	ρ_0	Fluid density at Logging reference point z_0
z_0	Logging reference point (usually at surface)	c_0	Fluid Compressibility at Logging reference point z_0
g	Standard gravity constant		

Equation

The static balance equation for fluid column is:

(2) $$\frac{dp}{dz} = \rho(p) \cdot g$$

Approximations

Incompressible fluid	Ideal Gas (Barometric formula)	Full-range model
(3) $p(z) = p_0 + \rho_0 \cdot g \cdot (z - z_0)$	(4) $p(z) = p_0 \cdot \exp\left[-\frac{\rho_0 \, g}{p_0} \cdot (z - z_0)\right]$	(5) $\frac{1 + c_0 \, p(z)}{1 + c_0 \, p_0} = \exp\left[\frac{c_0 \cdot \rho_0 \cdot g \cdot (z -$
(6) $p_2 - p_1 = \rho_0 \cdot g \cdot (z_2 - z_1)$	(7) $p_2 - p_1 = p_1 \cdot \left(\exp\left[\frac{\rho_0 \cdot g \cdot (z_2 - z_1)}{p_0}\right] - 1\right)$	(8) $p_2 - p_1 = \frac{(1 + c_0 \, p_1)}{c_0} \cdot \left(\exp\left[\frac{c_0 \cdot \rho_0 \cdot$

See also

Physics / Mechanics / Continuum mechanics / Fluid Mechanics / Fluid Statics

[Fluid Dynamics]