

Fluid Compressibility

@wikipedia

Compressibility of the fluid with density ρ and molar volume V_m as a function of temperature T and pressure p :

(1)
$$c(T, p) = \frac{1}{\rho} \left(\frac{\partial \rho}{\partial p} \right)_T = - \frac{1}{V_m} \left(\frac{\partial V_m}{\partial p} \right)_T$$

There is no universal full-range analytical model for Fluid Compressibility but there is a good number of approximations which can be effectively used in engineering practice.

Approximations

Incompressible fluid	Compressible fluid		
	Slightly compressible fluid	Strongly Compressible Fluid	
	Real Gas		Ideal Gas
(2) $c(T, p) = 0$	(3) $c(T, p) = c_0 = \text{const}$	...	(4) $c(T, p) = \frac{1}{p}$
(5) $\rho(T, p) = \rho_0(T)$	(6) $\rho(T, p) = \rho_0 \cdot \exp[c_0(T) \cdot (p - p_0)]$	...	(7) $\rho(T, p) = \frac{\rho_0(T)}{p_0} \cdot p$
(8) $Z(T, p) = \frac{p}{p_0}$	(9) $Z(T, p) = \frac{p}{p_0} \cdot \exp[-c_0(T) \cdot (p - p_0)]$	...	(10) $Z(T, p) = 1$

where

c	fluid compressibility
ρ	fluid density
Z	Z-factor

A number of full-range mathematical models of Fluid Compressibility can be found in Fluid Compressibility @model.

The multi-phase fluid compressibility is a linear sum of compressibilities of its phases (see multi-phase fluid compressibility @ model).

Fluid Compressibility of popular petroleum fluids at SPE Standard Conditions (STP):

Fluid	Typical Range, GPa^{-1}
Natural Gas	10,000
Gas Condensate	100
Oil	1 – 10
Water	0.44 – 0.51 GPa^{-1}

See also

[Physics](#) / [Mechanics](#) / [Continuum mechanics](#) / [Fluid Mechanics](#) / [Fluid Statics](#)

[[Compressibility](#)] [[Z-factor](#)]

[[Multi-phase compressibility @model](#)] [[Fluid Compressibility @model](#)]

[[Incompressible fluid](#)] [[Slightly Compressible Fluid](#)] [[Strongly Compressible Fluid](#)] [[Ideal Gas](#)]

[[Water compressibility \(\$c_w\$ \)](#)] [[Oil compressibility \(\$c_o\$ \)](#)] [[Gas compressibility \(\$c_g\$ \)](#)]