

Multiphase fluid compressibility @model

Compressibility of multiphase fluid in thermodynamic equilibrium at a given pressure p and temperature T is a linear sum of its single-phase components:

$$(1) \quad c_f(p, T) = \sum_{\alpha} s_{\alpha} \cdot c_{\alpha}(p, T)$$

where

s_{α}	α -phase volume share, subjected to $\sum_{\alpha} s_{\alpha} = 1$
$c_{\alpha}(p, T)$	α -phase compressibility as function of pressure p and temperature T

The total multiphase volume:

$$(2) \quad V = \sum V_{\alpha}$$

where V_{α} are volumes, occupied by individual phases.

The volume fraction of individual phase is defined as:

$$(3) \quad s_{\alpha} = \frac{V_{\alpha}}{V}$$

This leads to:

$$(4) \quad c_f = \frac{1}{V} \frac{\partial V}{\partial p} = \frac{1}{V} \sum \frac{\partial V_{\alpha}}{\partial p} = \sum \frac{V_{\alpha}}{V} \frac{1}{V_{\alpha}} \frac{\partial V_{\alpha}}{\partial p} = \sum s_{\alpha} c_{\alpha}$$

In most popular practical case of a 3-phase fluid model this will be:

$$(5) \quad c_f = s_w c_w + s_o c_o + s_g c_g$$

where $\{w, o, g\}$ mean water phase, oil phase and gas phase.

See also

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

