

Dupuit PI @model

A proxy model of Productivity Index for stabilised reservoir flow.

$$J = \frac{q}{p_{\text{frm}} - p_{wf}} = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} - \epsilon + S} = \frac{2\pi \cdot \frac{k h}{\mu}}{\ln \frac{r_e}{r_w} - \epsilon + S}$$

where

q	depending on application may mean a total sandface flowrate (q_t) or a product of surface flowrate and FVF ($q = q_{\text{srf}} B$)
p_{wf}	bottomhole pressure
p_{frm}	depending on application may mean a drain-boundary formation pressure (p_e) or drain-area formation pressure (p_r)
σ	formation transmissibility
r_w	wellbore radius
r_e	distance to a drainarea boundary
S	total skin
ϵ	a model parameter depending on Productivity Index definition and boundary type ($\epsilon = \{0, 0.5, 0.75\}$, see Table 1 below)

In case of [homogeneous reservoir](#) with only one vertical well producing the [Dupuit PI @model](#) is the exact analytical solution of [Reservoir Flow Model \(RFM\)](#).

Table 1. Variations to [Dupuit PI @model](#) depending on the [reservoir flow regime](#) and the definition/application of [Productivity Index](#).

	Drain-area Productivity Index , $J_r = \frac{q}{p_r - p_{wf}}$	Drain-boundary Productivity Index $J_e = \frac{q}{p_e - p_{wf}}$
Steady State flow regime (SS)	$J_r = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} - 0.5 + S}$	$J_e = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} + S}$
Pseudo-Steady State flow regime (PSS)	$J_r = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} - 0.75 + S}$	$J_e = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} - 0.5 + S}$

For the fractured vertical well the [geometrical skin-factor](#) S_G is related to [Fracture half-length](#) X_f as:

$$(1) \quad S_G = -\ln\left(\frac{X_f}{2r_w}\right)$$

$$J = \frac{q}{p_{\text{fm}} - p_{wf}} = \frac{2\pi\sigma}{\ln \frac{r_e}{r_w} - \epsilon + S} = \frac{2\pi M \cdot h}{\ln \frac{r_e}{r_w} - \epsilon + S} = \frac{2\pi k_{abs} \cdot h}{\ln \frac{r_e}{r_w} - \epsilon + S} \cdot M_r = T \cdot M_r(s_w, s_g)$$

See also

[Petroleum Industry](#) / [Upstream](#) / [Subsurface E&P Disciplines](#) / [Well Testing](#) / [Pressure Testing](#)

Reference

Dupuit, J., Etudes theoriques et pratiques sur le mouvement des eaux dans les canaux decouverts et a travers les terrains permeables, 2eme edition; Dunot, Paris, 1863.