Harmonic Production Decline

Specific type of production rate $q(t)$ decline:

(1) $q(t) = \frac{q_0}{1 + D_0\, t}$	(2) $Q(t) = \frac{q_0}{D_0} \ln\left[\frac{q_0}{q(t)}\right]$	(3) $Q_{\max} = \infty$	(4) $D(t) = \frac{D_0}{1 + D_0 \cdot t}$

where

$q_0 = q(t = 0)$	Initial production rate of a well (or groups of wells)
$D_0 > 0$	initial Production decline rate
$Q(t) = \int_0^t q(t)\, dt$	cumulative production by the time moment t
$Q_{\max} = \int_0^\infty q(t)\, dt$	Estimated Ultimate Recovery (EUR)
$D(t) = -\frac{dq}{dQ}$	Production decline rate

It can be applied to any fluid production: water, oil or gas.

Harmonic Production Decline is an empirical correlation for production from the infinite-reserves $Q_{\max} = \infty$ reservoir.

The Production decline rate is starting at its maximum D_0 and then gradually reduces to zero.

This usually happens at early stages of production when the total reservoir volume is not yet engaged.

Although the anthropogenic restriction of production in mature fields may lead to a similar behaviour.

The Harmonic decline is also observed at the mature stage of waterflood projects.

A typical example of various fitting efforts of Harmonic Production Decline are brought on **Fig. 1** – **Fig. 3** with harmonic fitting being a clear winner.

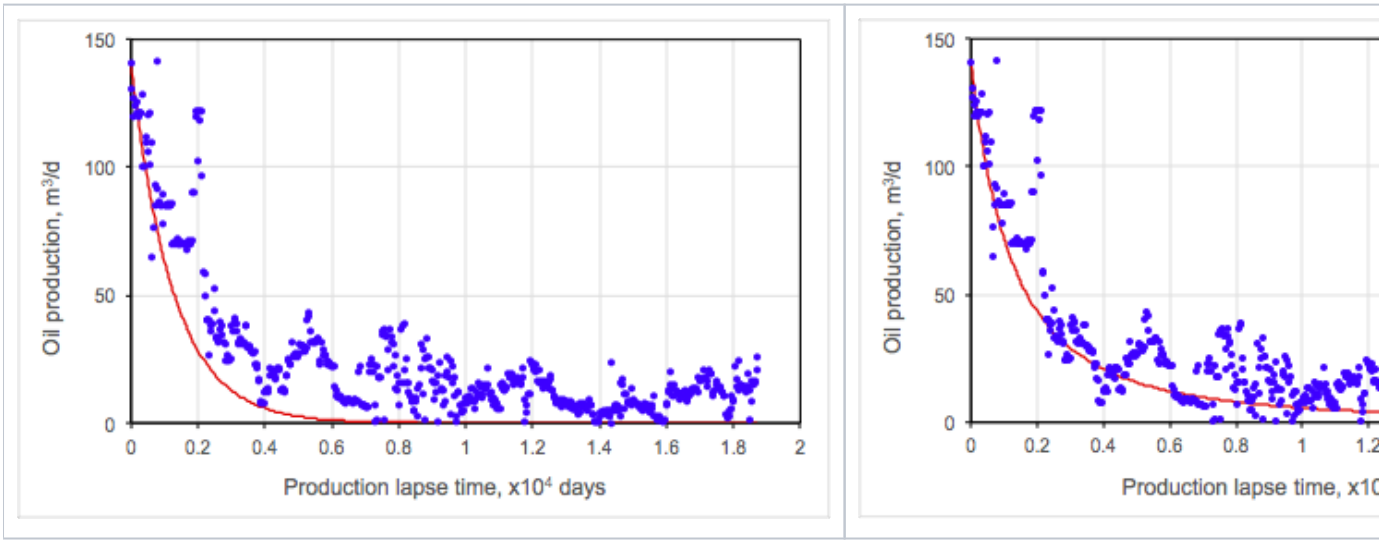

Fig. 1. Exponential best ft to Harmonic Production Decline	**Fig. 2**. Hyperbolic best ft to Harmonic Produc

See Also

Petroleum Industry / Upstream / Production / Subsurface Production / Field Study & Modelling / Production Analysis / Decline Curve Analysis

[DCA Arps @model] [Production decline rate]