Pressure Pulse Propagation

The general form of pressure dynamics (see Universal view of 1D-Radial low-compressibility diffusion):

(1) $$p(t, \mathbf{r}) = p_i + \frac{qB}{4\pi\sigma} F\left(\frac{r^2}{4\chi t}\right)$$

suggest that isobars

(2) $$p(t, \mathbf{r}) = p_i + \frac{qB}{4\pi\sigma} F\left(\frac{r^2}{4\chi t}\right) = \mathrm{const}$$

will be honouring the following equation:

(3) $$\frac{r^2}{4\chi t} = \mathrm{const}$$

or

(4) $$r(t) = r_w + 2\sqrt{\chi t}$$

which means it will be moving with the phase velocity (see also Formation Pressure Dynamics):

(5) $$u_{p=\mathrm{const}} = \sqrt{\frac{\chi}{t}}$$

and slowing down in time.

The practical range for this velocity is around 0.01 m/s which is much higher than actual fluid propagation in typical subsurface reservoirs $3 \cdot 10^{-6}$ m/s (circa 100 metres per year) .

This makes pressure pulsation an effective reservoir scanning technique.

See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Well Testing / Pressure Testing