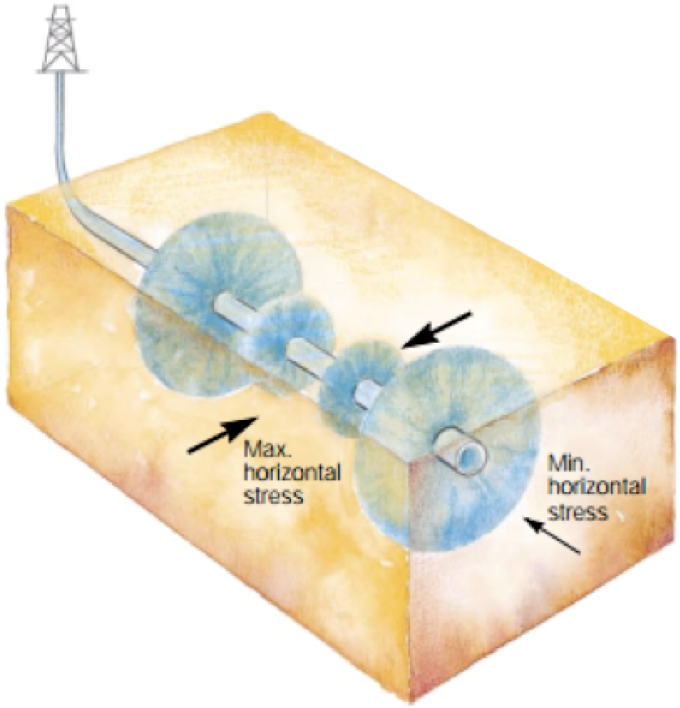
Hydraulic fracturing to determine S_3



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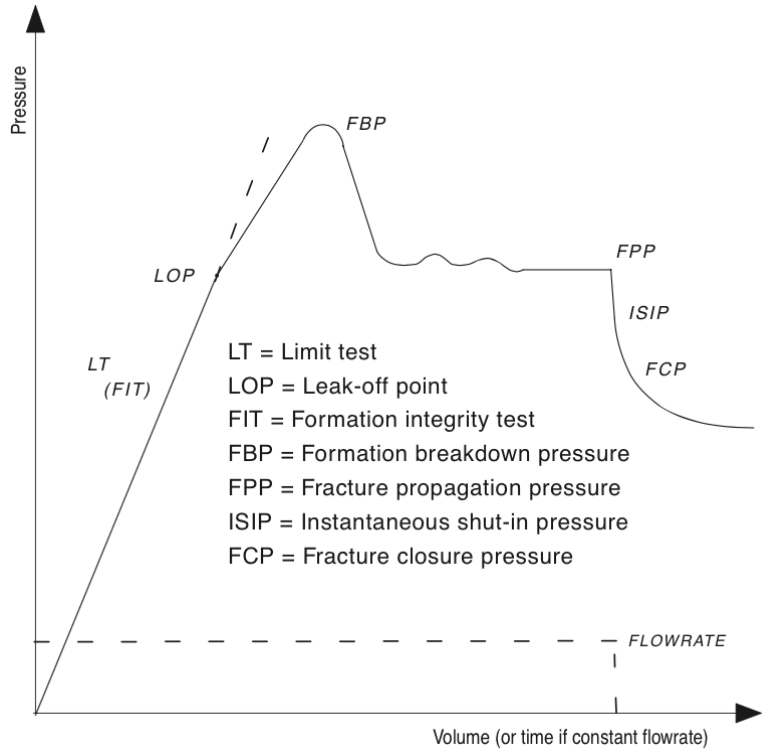
Hydraulic fracture initiation in vertical well

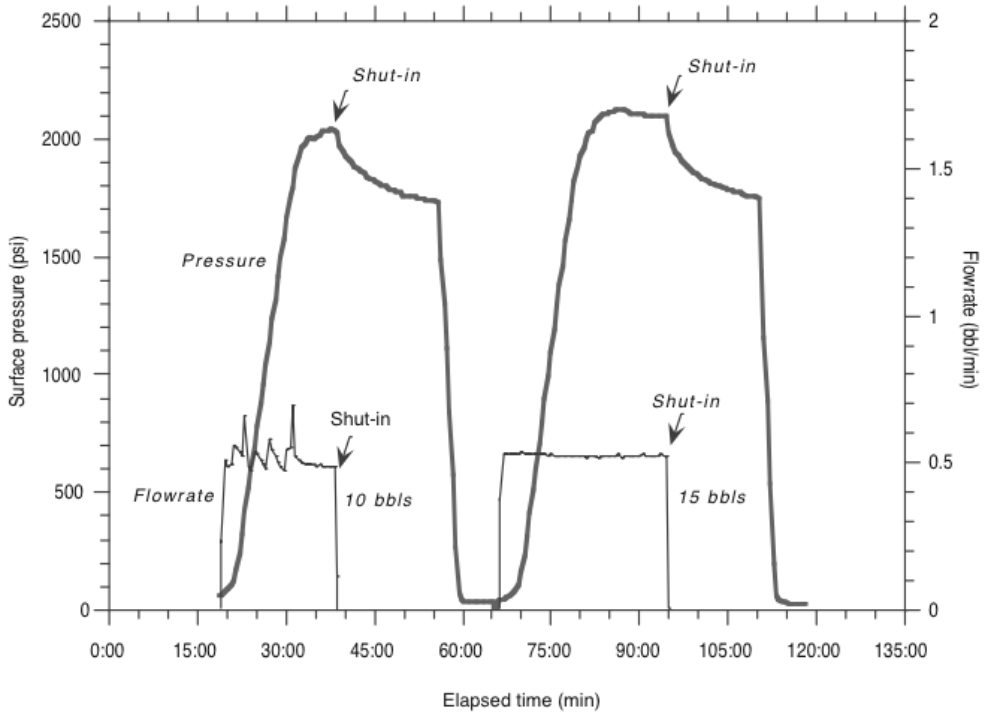
$$\sigma_{\theta\theta}^{min} = 3S_{hmin} - S_{Hmax} - 2P_p - \Delta P - \sigma^{\Delta T} = -T_0$$

Leakoff test (mini-frac, FIT, XLOT)

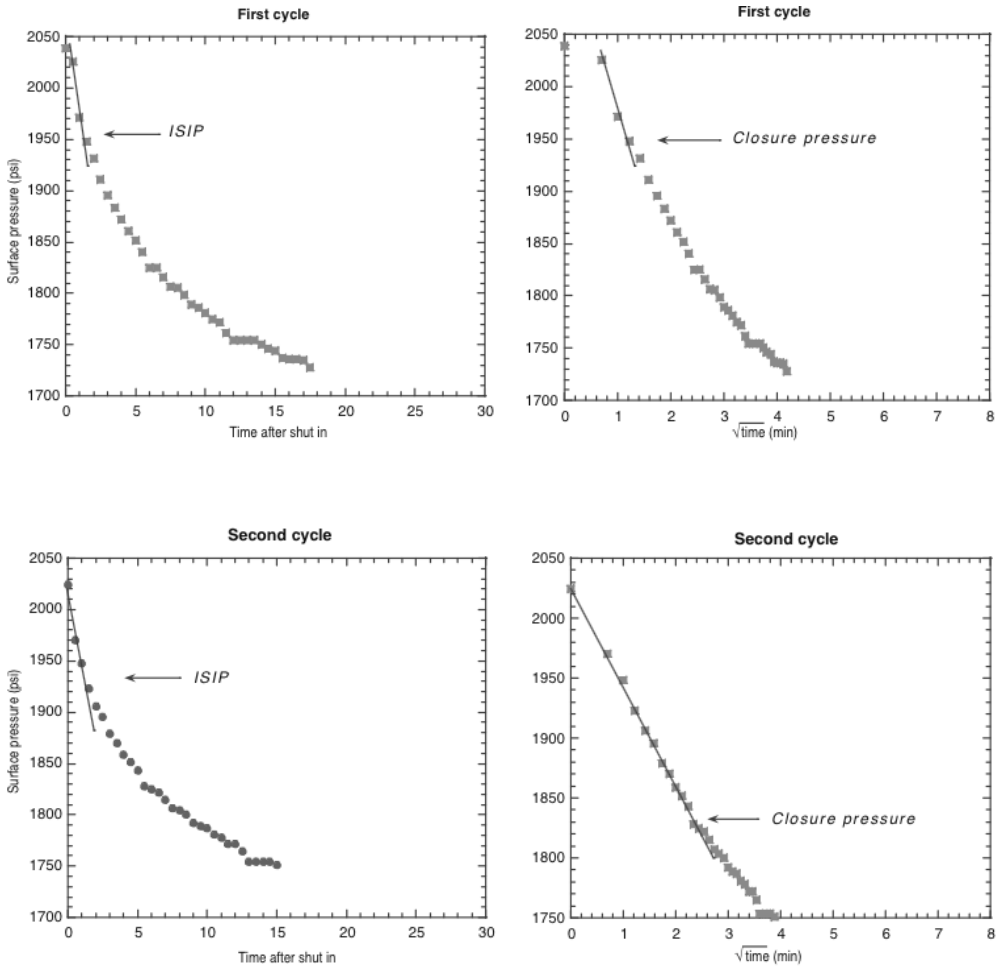


 Zoback, *Reservoir Geomechanics* (Fig. 7.2, pp. 211)

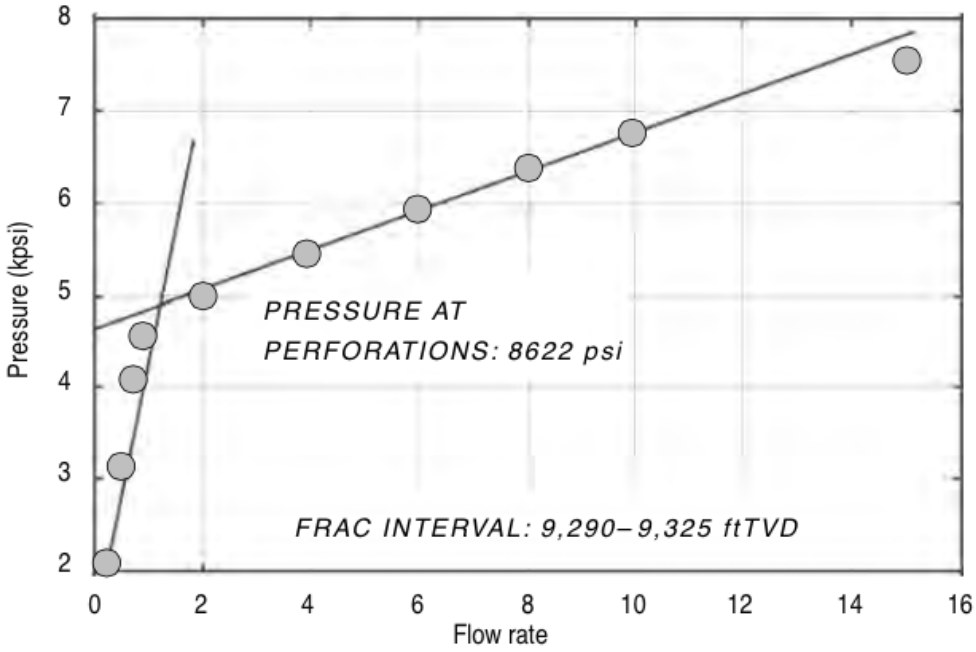
S_3 from instantaneous shut-in pressure



 Zoback, *Reservoir Geomechanics* (Fig. 7.3, pp. 213)



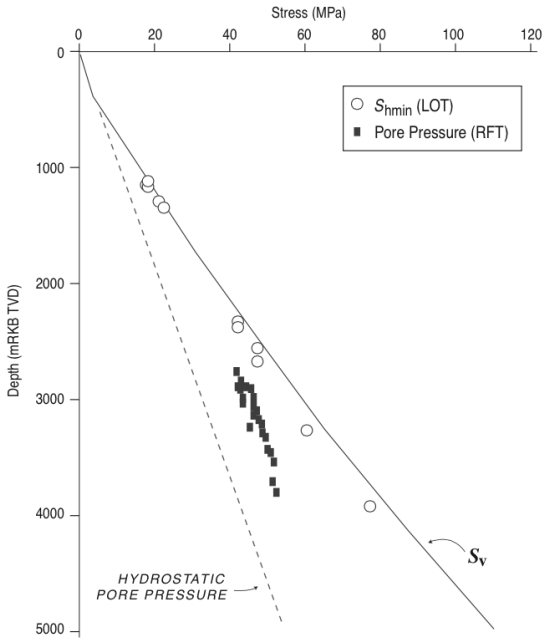
Step-rate test



 Zoback, *Reservoir Geomechanics* (Fig. 7.5, pp. 216)

Be careful!

When $S_3 \sim S_v$ integrate density logs



What about S_{Hmax}?

$$\Delta P = P_b - P_p$$

so

$$S_{Hmax} = 3S_{hmin} - P_b - P_p + T_0$$

or

$$S_{Hmax} = 3S_{hmin} - P_b(T = 0) - P_p$$

Does it work?

Consider a system with compressibility β_s

$$\beta_s = \frac{\Delta V_s}{V_s}\frac{1}{\Delta P}$$

$$\Delta P = \frac{1}{\beta_s V_s}\Delta V_s$$

$$\frac{\Delta P}{\Delta t} = \frac{1}{\beta_s V_s}\frac{\Delta V_s}{\Delta t}$$

Answer: Not very well.