

$$m \left( \frac{d^2 r}{dt^2} \right) = m \left( \frac{V_\phi^2}{r} \right) \left( 1 - \frac{\rho_c}{\rho_\phi} \right) - \beta \left( \frac{dr}{dt} + V_r \right)$$

$$m \left( \frac{d^2 r}{dt^2} \right) = \beta \left( V_r - \frac{dr}{dt} \right) - m \left( \frac{V_\phi^2}{r} \right) \left( 1 - \frac{\rho_c}{\rho_\phi} \right)$$

$$A' = m \left( A^* \right)^2 \frac{\left( 1 - \frac{\rho_c}{\rho_\phi} \right)}{\beta}$$

$$\frac{d^2 r}{dt^2} = 0$$

$$\frac{dr}{dt} + \frac{B^*}{r} = \frac{A'}{r^3}$$

$$V = \frac{dr}{dt} = \frac{A'}{r^3} - \frac{B^*}{r} \qquad \frac{dV}{dr} = -\frac{3A'}{r^4} + \frac{B^*}{r^2}$$

$$\frac{d^2 r}{dt^2} = \frac{dV}{dt} = \frac{dV}{dr} \frac{dr}{dt} = V \frac{dV}{dr} = V \left( -\frac{3A'}{r^4} + \frac{B^*}{r^2} \right)$$

$$m \frac{dr}{dt} \left( \frac{B^*}{r^2} - \frac{3A'}{r^4} \right) = \frac{A' \beta}{r^3} - \beta \left( \frac{dr}{dt} + \frac{B^*}{r} \right)$$

$$dt = \frac{mB^* r^2 - 3A'm + \beta r^4}{\beta r (A' - B^* r^2)} dr$$

$$t_{cp} = \frac{V_o}{Q_o}$$

$r > dz_0$  – уйдут с  
 песками,  
 $r = dz_0$  – 50/50.

$$\frac{3r^*}{A^*} \left[ \frac{2\rho_c v B^*}{\rho_\phi - \rho_c} \right]^{0,5} = K \quad d_{ex} = 0,8d_\epsilon$$

$$d_\epsilon = 0,33D; \quad d_{ex} = 0,25D; \quad Lu = 1,5D$$

$$\frac{d_\epsilon}{d_H} = 0,5 \quad D = 2,6 \frac{d_{\min}^2 V_{ex} (\operatorname{tg} \alpha)^{0,4} |\rho_\phi - \rho_c|}{\operatorname{tg} \frac{\alpha}{2} \mu_c}$$

$$\xi = \frac{2P_{ex}}{\rho V_{ex}^2} = 7,5 \left( \frac{\text{Re} \cdot Fr}{\frac{V_{ex}^3}{\nu_\partial}} \right)^{0,135} \left( \frac{F_{ex}}{D^2} \right)^{0,98} \left( \frac{F_{6yx}}{D^2} \right)^{-0,45} \left( \frac{L}{D} \right)^{-0,42} (\text{tg}\alpha)^{0,29}$$

$$V_{ex} = \frac{0,585 P_{ex}^{0,416} \mu_c^{0,056}}{\rho_c^{0,47} (\text{tg}\alpha)^{0,12}}$$

$$D = \frac{4,12 d_{\min}^2 P_{ex}^{0,415} (\text{tg}\alpha)^{0,28}}{\text{tg} \frac{\alpha}{2} \rho_c^{0,47} \mu^{0,95}} \left| \rho_\phi - \rho_c \right|$$

$F(d_4)$

100%

50%

$x_0$

$d_{min}$

$d_{zp}$

$d_{max}$

$d_4$

$x_n$

















