

$$\begin{aligned}
 h_k &= \frac{R-r}{r} h_0 \\
 y &= h_k \rightarrow y = \sqrt[3]{\frac{R^2 h_k h_0^2 + R r h_k h_0^2 + r^2 h_k h_0^2}{r^2}} - h_0 \\
 &= \sqrt[3]{\frac{R^2 \left(\frac{R-r}{r}\right) h_0^3 + R r \left(\frac{R-r}{r}\right) h_0^3 + r^2 \left(\frac{R-r}{r}\right) h_0^3}{r^2}} - h_0 \\
 &= \sqrt[3]{\frac{(R^2 + Rr + r^2) h_0^3}{r^2}} - h_0 \\
 &= \sqrt[3]{\frac{R^3 h_0^3}{r^2}} - h_0 = \frac{R}{r} h_0 - h_0 \\
 y &= \left(\frac{R-r}{r}\right) h_0 = h_k
 \end{aligned}$$

Kesimpulan:

$$V = V_s + V_k, \quad V_k = \frac{1}{3} \pi [R^2 + Rr + r^2] h_k$$

$$V > V_k \rightarrow y = h_k + \frac{V - V_k}{\pi R^2}$$

$$V = V_k \rightarrow y = h_k$$

$$V < V_k \rightarrow y = \left(\frac{3V h_0^2 + \pi r^2 h_0^3}{\pi R^2} \right)^{\frac{1}{3}} - h_0$$

$$h_0 = \frac{r}{R-r} h_k$$

$$\text{check: } V = 0 \rightarrow y = 0 \quad \text{OK}$$

$$V = V_k \rightarrow y = h_k \quad \text{OK}$$

Parameter yang diukur:

$R, r, h_k \rightarrow V \text{ to } y$
 h_s (tinggi silinder) $\rightarrow V_{\max}$ silo

$$V_{\max} = V_k + V_{s\max}$$

$$= V_k + \pi R^2 h_s$$

MATLAB
FUNCTION

volume_to_level

$V_{\text{to-}} y$