

$$\lambda = \frac{1}{25}$$

8.52 If the scale ratio between a model spillway and its prototype is $\frac{1}{25}$, what velocity and discharge ratio will prevail between model and prototype? If the prototype discharge is 3000 m³/s, what is the model discharge?

8.52

$$\lambda = \frac{1}{25} \text{ for } V_m/V_p \text{ and } Q_m/Q_p$$

$$\text{for } Q_p = 3000 \text{ m}^3/\text{s} \text{ for } Q_m$$

$$F_{r_m} = F_{r_p}$$

$$\lambda = L_m/L_p = 1/25$$

$$\frac{V_m}{\sqrt{g L_m}} = \frac{V_p}{\sqrt{g L_p}}$$

$$\frac{A_m}{A_p} = \frac{L_m^2}{L_p^2} = \left(\frac{L_m}{L_p}\right)^2 = \lambda^2$$

$$V_m/V_p = \underbrace{\sqrt{L_m/L_p}}_{\sqrt{\lambda}} = \sqrt{1/25} = 1/5$$

$$\frac{Q_m}{Q_p} = \frac{V_m A_m}{V_p A_p} = \sqrt{\lambda} \cdot \frac{A_m}{A_p} = \lambda^{1/2} \cdot \lambda^2 = \lambda^{5/2}$$

$$= (1/25)^{5/2} = 1/3125$$

$$Q_m = 3000 / 3125$$

$$= .96 \text{ m}^3/\text{s}$$