

Offset Mass Material : 1020 Steel

1020 steel Density,  $\rho_{om} = 0.29 \text{ lbm/in}^3$

Offset Mass 1

$\nabla = 5.83 \text{ in}^3$ ,  $m_o = 1.6907 \text{ lbm}$ ,  $e = 1.36 \text{ in}$ .

$$F_o(\omega_{n1}) = (1.6907 \text{ lbm}) (1.36/12 \text{ ft}) (50.571 \text{ rad/s})^2$$

$$F_o(\omega_{n1}) = 490.035 \text{ lbm} \cdot \text{ft/s}^2$$

NOTE:  $1 \text{ lbf} = 32.2 \text{ lbm} \cdot \text{ft/s}^2$

$$\begin{aligned} & \text{lbm} \cdot \text{ft} \cdot \frac{\text{rad}^2}{\text{s}^2} \\ & \downarrow \\ & \text{lbm} \cdot \text{ft/s}^2 \end{aligned}$$

$$\rightarrow F_o(\omega_{n1}) = 15.218 \text{ lbf}$$

$$F_o(\omega_{n2}) = (1.6907 \text{ lbm}) (1.36/12 \text{ ft}) (151.079 \text{ rad/s})^2$$

$$F_o(\omega_{n2}) = 4373.533 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n2}) = 135.824 \text{ lbf}$$

Offset Mass 2

$\nabla = 5.98 \text{ in}^3$ ,  $m_o = 1.71 \text{ lbm}$ ,  $e = 1.39 \text{ in}$ .

$$F_o(\omega_{n1}) = (1.71 \text{ lbm}) (1.39/12) (50.571 \text{ rad/s})^2$$

$$F_o(\omega_{n1}) = 506.562 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n1}) = 15.731 \text{ lbf}$$

$$F_o(\omega_{n2}) = (1.71 \text{ lbm}) (1.39/12) (~~50.571~~ 151.079 \text{ rad/s})^2$$

$$F_o(\omega_{n2}) = 4521.035 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n2}) = 140.405 \text{ lbf}$$

### Offset Mass 3

$$\rightarrow V = 10.01 \text{ in}^3, \quad m_o = 2.86 \text{ lbm}, \quad e = 1.03 \text{ in.}$$

$$F_o(\omega_{n1}) = (2.86 \text{ lbm})(1.03/12 \text{ ft})(50.571 \text{ rad/s})^2$$

$$F_o(\omega_{n1}) = 627.805 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n1}) = 19.497 \text{ lbf}$$

$$F_o(\omega_{n2}) = (2.86 \text{ lbm})(1.03/12 \text{ ft})(151.079 \text{ rad/s})^2$$

$$F_o(\omega_{n2}) = 5603.124 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n2}) = 174.010 \text{ lbf}$$

### Offset Mass 4

$$\rightarrow V = 8.15 \text{ in}^3, \quad m_o = 2.32 \text{ lbm}, \quad e = 1.18 \text{ in.}$$

$$F_o(\omega_{n1}) = (2.32 \text{ lbm})(1.18/12 \text{ ft})(50.571 \text{ rad/s})^2$$

$$F_o(\omega_{n1}) = 583.434 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n1}) = 18.119 \text{ lbf}$$

$$F_o(\omega_{n2}) = (2.32 \text{ lbm})(1.18/12 \text{ ft})(151.079 \text{ rad/s})^2$$

$$F_o(\omega_{n2}) = 5207.112 \text{ lbm} \cdot \text{ft/s}^2$$

$$\rightarrow F_o(\omega_{n2}) = 161.712 \text{ lbf}$$