

Problem 7.9

A diameters of the main rotor and tail rotor of a single-engine helicopter are 7.6 m and 1.02 m, respectively. The respective rotator speeds are 450 rev/min and 4138 rev/min. Determine the speeds of the tips of both rotors, and compare it with the speed of sound at 343 m/s.

1.)

A diameters of the main rotor and tail rotor of a single-engine helicopter are 7.6 m and 1.02 m, respectively. The respective rotator speeds are 450 rev/min and 4138 rev/min. Determine the speeds of the tips of both rotors, and compare it with the speed of sound at 343 m/s.

$$7.6 \text{ meter diameter at } (450 \text{ rev/min})(2\pi \text{ rad/rev})\left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = 47 \text{ rad / sec}$$

$$1.02 \text{ meter diameter at } (4138 \text{ rev/min})(2\pi \text{ rad/rev})\left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = 433.3 \text{ rad / sec}$$

$$v_{7.6} = R\omega_{7.6}$$

$$= ((7.6 \text{ meters/rad}) / 2)(47 \text{ rad/sec})$$

$$= 179 \text{ m/s}$$

$$v_{1.02} = R\omega_{1.02}$$

$$= ((1.02 \text{ meters/rad}) / 2)(433.3 \text{ rad/sec})$$

$$= 221 \text{ m/s}$$

Neither are faster than the speed of sound.

2.)