EM 378 Supplemental Instruction

9/05/19

Viscosity Applications

1.76. A sled slides along on a thin horizontal layer of water between the ice and the runners. The horizontal force that the water puts on the runners is equal to 1.2 lb when the sled’s speed is 50 ft/s. The total area of both runners in contact with the water is 0.08 ft$^2$, and the viscosity of the water is $3.5 \times 10^{-5}$ lb-s/ft$^2$. Determine the thickness of the water layer under the runners. Assume a linear velocity distribution in the water layer.
1.77. A 25-mm-diameter shaft is pulled through a cylindrical bearing as shown. The lubricant that fills the 0.3-mm gap between the shaft and the bearing is an oil having a kinematic viscosity of $8.0 \times 10^{-4}$ m$^2$/s and a specific gravity of 0.91. Determine the force $P$ required to pull the shaft at a velocity of 3 m/s. Assume the velocity distribution in the gap is linear.