inertia of link 2 about pivot O_2 was determined from a CAD solid model of the link to be 0.0325 kg-m^2. The effective mass of link 2 placed at point *B* is then

$$m_{2_{eff}} = \frac{I_{ZZ}}{r^2} = \frac{0.0325}{0.283^2} = 0.4058 \text{ kg} \tag{b}$$

6 The mass m_1 of the roller follower is 0.196 kg obtained from the manufacturer's catalog information.

7 The next step is to bring all these lumped masses back to the roller follower location at point *A* where we wish to place the effective mass of the system. This will require the application of any link ratios that may be present.

8 First, bring mass m_5 across the bellcrank from point *D* to *C* using the radii of link 4 in equation 8.18b.

$$m_{5\,@\,C} = m_5\left(\frac{r_5}{r_4}\right)^2 = 0.9\left(\frac{0.185}{0.173}\right)^2 = 1.029 \text{ kg} \tag{c}$$

9 Add the effective masses of links 4 and 5 at point *C*.

$$m_C = m_{4_{eff}} + m_{5\,@\,C} = 0.2908 + 1.029 = 1.3198 \text{ kg} \tag{d}$$

10 Bring the mass m_C and the mass of the connecting rod m_3 down to point *B* and add them to the effective mass of link 2 at that point.

$$m_B = m_C + m_3 + m_{2_{eff}} = 1.3198 + 0.8338 + 0.4058 = 2.5594 \text{ kg} \tag{e}$$

11 Bring the total mass lumped at point *B* back to the follower at point *A* with equation 8.18b and add it to the mass of the roller that is there.

$$m_{eff} = m_A = m_B\left(\frac{r_2}{r_1}\right)^2 + m_1 = 2.5594\left(\frac{0.283}{0.127}\right)^2 + 0.196 = 12.905 \text{ kg} \tag{f}$$

This is the effective mass to be used in the 1-DOF model of the system.

12 Next, the compliances of each element must be combined to find the overall effective spring constant of the system as felt at the cam follower, point *A*. Figure 8-18 shows a schematic of the various compliant elements that comprise this system. Note that the air cylinder does not contribute to this compliance. It essentially provides a near constant force as shown in Figure 8-12c, due to the accumulator. As will be seen in Chapter 10, as long as the spring or air cylinder used to close the cam follower joint in this type of "industrial" cam-follower system has sufficient force to prevent follower jump, then its spring constant will not affect the overall compliance of the system.

13 The bellcrank, link 4, can best be modeled as a double-cantilever beam. Standard beam equations available from references such as [4] can be used in combination with the beam's cross-section geometry to determine the deflection and thus the spring rate of each half of the double-cantilever beam. However, in this case, the cross section of the beam is