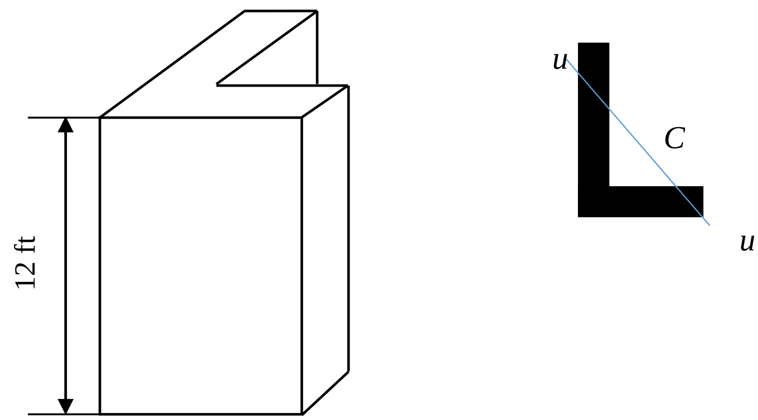
8-8. A steel angle has a cross-section area of $A = 3\,\text{in}^2$. The smallest redius of gyration occurs about the *u*-*u* axis and is $r_u = 0.67\,\text{in}$. The angle is 12-ft-long and is pin-connected in a system. Assume that the modulus of elasticity follows $E \sim N\left(29\times10^3,\,(2\times10^3)^2\right)\text{ksi}$. Determine the distribution of the critical axial buckling load that can be applied through its centroid *C*.



Solution:

The critical stress is

$$S_{cr} = \frac{\pi^2 E}{\left(\frac{KL}{r_u}\right)^2} = \frac{(3.14)^2}{\left(\frac{1\times12\times12}{0.67}\right)^2} E = (2.1366\times10^{-4})E\,, \qquad \text{where } K = 1.$$

The critical axial buckling load is

$$P_{cr} = S_{cr}A = (2.1366\times10^{-4})(3)\,\text{E} = (6.4098\times10^{-4})\,\text{E}$$

Since $E \sim N\left(29\times10^3,\,(2\times10^3)^2\right)\text{ksi}$, we have

$$\mu_{P_{cr}} = \left(6.4098\times10^{-4}\right)\mu_E = 18.588\,\text{ksi}$$

$$\sigma_{P_{cr}} = \left(6.4098\times10^{-4}\right)\sigma_E = 1.282\,\text{ksi}$$

Thus, the critical axial buckling load follows $P_{cr} \sim N\left(18.588,\, 1.282^2\right)$ ksi . **Ans.**