for the outer part. For the inner part, Equations (51a, b), (52), (53), (54), and (55) apply. The latter equation applies with $q_3 = 0$. Equation (56) is valid and can be used to find p/σ_1 for the liner. [Equation (56) is not needed since p_3 is given.] Solving for p/σ_1, one finds

$$\frac{p}{\sigma_1} = \frac{\alpha_r (k_1^2 - 1)}{\left[\frac{k_1^2+1}{2} - \frac{2}{g}\frac{k_1^2}{(k_1^2-1)} - 2\frac{E_1}{E_3}\frac{p_3}{p}\frac{k_1^2 k_2 k_3^2}{g(k_3^2-1)}\right]} \tag{61}$$

This equation shows that an increase in p_3/p gives an increase in p/σ_1.

Let σ_3 be the ultimate tensile strength of component 3, the outer cylinder of the inner part of the ring-fluid-segment container. If fatigue relation, Equation (9) is used for this cylinder, then there results

$$\sigma_3 = \frac{k_3^2}{k_3^2-1}\left[\frac{5}{2}(p_2 - p_3) - \frac{1}{2} q_2\right] \tag{62}$$

The pressures p_2 and q_2 are related to p_1 and q_1 via Equations (51a, b). p_1 and q_1 are related by Equation (55) with $q_3 \equiv 0$. One other equation involving p_1 and q_1 is needed which is found from the Definition (10b) for the parameter α_m, i.e.,

$$\alpha_m \sigma_1 = \sigma_m = \frac{(\sigma_\theta)_{max} + (\sigma_\theta)_{min}}{2} = \frac{p}{2}\frac{k_1^2 + 1}{k_1^2 - 1} - \frac{(p_1 + q_1)}{k_1^2 - 1} k_1^2$$

at r_o.

Solving for p_1 and q_1, finding p_2 and q_2, substituting into Equation (62), and solving for p/σ_3, one obtains

$$\frac{p}{\sigma_3} = \frac{(k_3^2 - 1)}{k_3^2\left\{\frac{2}{k_2}\frac{q_1}{p} + \frac{5}{g(k_1^2-1)\,k_2} + \frac{5}{2}\frac{p_3}{p}\left[\frac{2E_1}{gE_2}\frac{k_3^2}{(k_3^2-1)} - 1\right]\right\}} \tag{63}$$

where

$$\frac{q_1}{p} = \frac{(\alpha_r - \alpha_m)}{2}\frac{(k_1^2 - 1)}{k_1^2}\frac{\sigma_1}{p} \quad .$$

The pressure-to-strength ratios p/σ_1 and p/σ_3 are plotted in Figures 53 and 54 as a function of segment size k_2 and wall ratio K' for $k_1 = 1.1$, $p_3/p = 0.2$, $\alpha_r = 0.5$, and $\alpha_m = -0.5$. The pressure-to-strength ratios increase with K' or equivalently with k_3, since $K' = k_1 k_2 k_3$. The behavior shown for $k_1 = 1.1$ is the same as that found previously for the ring-segment container; i.e., p/σ_3 increases with increasing k_2, but p/σ_1 decreases. However, if k_1 is increased to 1.5 from 1.1, then p/σ_1 also increases with

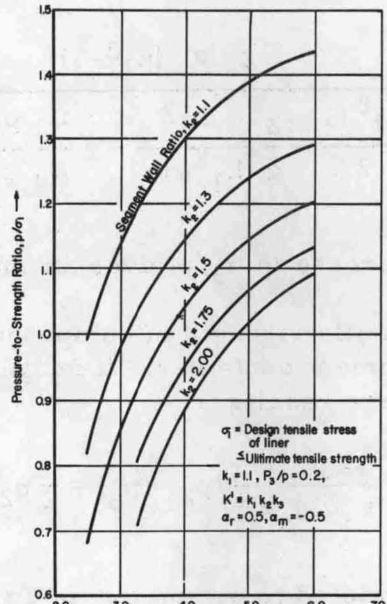

FIGURE 53. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/σ_1, FOR THE RING-FLUID-SEGMENT CONTAINER

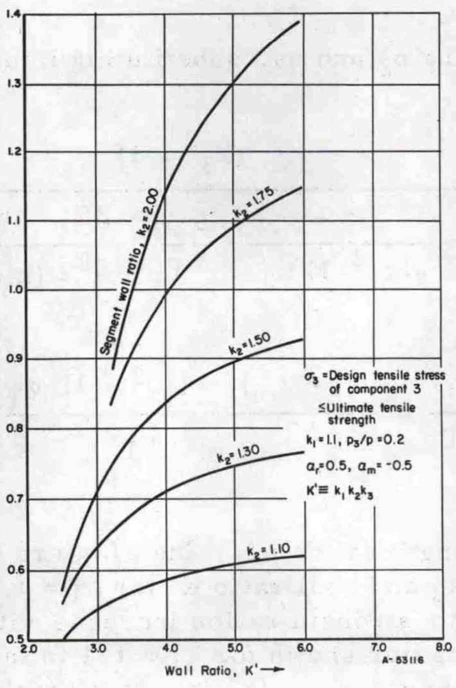

FIGURE 54. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/σ_3, FOR THE RING-FLUID-SEGMENT CONTAINER