$$b_m = \left(\frac{-p_2}{2} + \frac{\tau}{2}\right) \frac{mk_2^{\ 2}}{\beta_2} (k_2^{\ 2} - 1)$$

$$- \left(\frac{-p_2}{2} - \frac{\tau}{2}\right) \frac{m(k_2^{\ 2} - k_2^{\ 2m+2})}{(m + 1)\,\beta_2}$$

$$c_m = - \left(\frac{-p_2}{2} + \frac{\tau}{2}\right) \frac{k_2^{\ 2} (1 - k_2^{\ -2m})}{\beta_2} \qquad (105)$$

$$+ \left(\frac{-p_2}{2} - \frac{\tau}{2}\right) \left[\frac{(1 - m^2)\,k_2^{\ 2} - k_2^{\ -2m+2} + m^2}{\beta_2\,(m + 1)}\right]$$

$$d_m = \left(\frac{-p_2}{2} + \frac{\tau}{2}\right) \frac{mk_2^{\ 2} (k_2^{\ 2} - k_2^{\ -2m})}{\beta_2\,(m - 1)}$$

$$+ \left(\frac{-p_2}{2} - \frac{\tau}{2}\right) \frac{m}{\beta_2} k_2^{\ 2} (k_2^{\ 2} - 1)$$

where

$$\beta_2 \equiv m \left[-m^2 k_2^{\ 4} + 2\,(m^2 - 1)\,k_2^{\ 2} + k_2^{\ 2-2m} + k_2^{\ 2m+2} - m^2\right] \qquad (106)$$

The bending solution is found in a similar manner to the method used previously for the ring segment. The resulting total stresses and displacements for the pin segment are given in Equations (22a-c) and (23a, b) in the text. The functions $g_{m1}(r)$, $g_{m2}(r)$, and $g_{m3}(r)$ in Equations (22a-c) are recognized as the coefficients of cos $m\theta$ and sin $m\theta$ in Equations (103a-c). $g_{m4}(r)$ and $g_{m5}(r)$ in Equations (23a, b) are defined as:

$$g_{m4} \equiv -m(1 + \nu)\,a_m\,\rho^{m-2} + \left[2(1 - \nu) - m\,(1 + \nu)\right] b_m\,\rho^m$$

$$+m(1 + \nu)\,c_m\,\rho^{-m-2} + \left[2(1 - \nu) + m\,(1 + \nu)\right] d_m\,\rho^{-m}$$

$$g_{m5} \equiv m\,(1 + \nu)\,a_m\,\rho^{m-2} + m\left[\frac{m + 4}{m} + \nu\right] b_m\,\rho^m \qquad (107a, b)$$

$$+m\,(1 + \nu)\,c_m\,\rho^{-m-2} + m\left[\frac{m - 4}{m} + \nu\right] d_m\rho^{-m}$$

and G_2 is defined as

$$G_2 \equiv \frac{r_o}{E} \left\{ m\,(1 + \nu)\,a_m\left(\frac{r_o}{r_2}\right)^{m-2} - [2\,(1 - \nu) - m\,(1 + \nu)]\ g_m\left(\frac{r_o}{r_2}\right)^m \right.$$

$$\left. -m\,(1 + \nu)\,c_m\left(\frac{r_o}{r_2}\right)^{m-2} - [2\,(1 - \nu) + m\,(1 + \nu)]\ d_m\left(\frac{r_o}{r_2}\right)^{-m} \right\} \qquad (107c)$$

where

$$r_o = \frac{r_1 + r_2}{2} .$$

The bending moment is $M_2 p_1 r_1^2$ where

$$M_2 = \frac{1}{k_2^2 - 1} \left[\frac{k_2^2 - 1}{2} + k_2^2 \log k_2 \right] + p_2 \left[\frac{k_2^2}{2} + \frac{k_2^2 \log k_2}{k_2^2 - 1} \right]$$

$$+ \frac{1}{p_1} \left\{ - (m - 1) a_m k_2^{-m+2} \left[k_2^m - 1 \right] - (m + 1) b_m k_2^{-m} \left[k_2^{m+2} - 1 \right] \right.$$

$$\left. + (m + 1) c_m k_2^{m+2} \left[k_2^{-m} - 1 \right] - (m - 1) d_m k_2^m \left[k_2^{-m+2} - 1 \right] \right\} \qquad (108)$$

β_1 was defined previously by Equation (95).

The equations for stresses and deflections in pin segments were programmed on the computer and some calculations were carried out. Table LVII gives some results for $k_2 = 4.0$ and $\alpha = 60°$. At $\theta = \alpha/4 = 15°$ and $r/r_1 = 4$, edge of pin hole, it is noted that $\sigma_\theta / p_1 = 2.01$. This indicates the stress concentration effect of the hole. At $\theta = \alpha/2 = 30°$ appreciable σ_θ stress remains. The edge of the segment should be free of stress. Therefore, the results must be considered approximate. However, the residual σ_θ stress on the edge is self equilibrating and its removal would be expected to cause only a local effect near the edge according to the St. Venant principle.

Bending of the pin segment again is evident as shown by the v displacement. The variation of displacements and of the maximum σ_θ stress at the hole with segment geometry are shown in Table LVIII. Larger u displacements and smaller hoop stresses are found for larger k_2 and α. The bending displacement v increases with α but decreases with k_2.

The bending of pin segments would cause the inside corners to dig into the liner just as in the ring segments (Figure 78a). Therefore, an inside diameter of the segments larger than the outside diameter of the liner would again be recommended to counteract the bending effect.

SOLUTION FOR SHEAR STRESSES IN PINS

The pins of the pin-segment container are subject to shear and bending as shown in Figure 81. The shear stress is larger than the bending stress and will be used as the critical stress in the pins. The maximum shear stress in a circular pin is given by

$$\tau_{max} = \frac{4}{3A} (P/2)$$