where:

$$f_1(r) = \left(\frac{r_2}{r}\right)^2 \log k_2 + k_2^2 \log \left(\frac{r}{r_2}\right) + \log \left(\frac{r_1}{r}\right)$$

$$f_2(r) = -\left(\frac{r_2}{r}\right) \log k_2 + k_2^2 \log \left(\frac{r}{r_2}\right) + \log \left(\frac{r_1}{r}\right) + k_2^2 - 1$$

$$f_3(r) = -4\,(1+\nu)\left(\frac{r_2}{r}\right) \log k_2 + 4(1-\nu)\left[k_2^2 \log \left(\frac{r}{r_2}\right) - \log \left(\frac{r}{r_1}\right)\right] - 4\,(k_2^2 - 1) \tag{20a-c}$$

and where $(\sigma_r)_c$, $(\sigma_\theta)_c$, and $(u)_c$ are given by Equations (13a-c) and (14a, b) for $k_n = k_2$, $p_{n-1} = p_1$, $p_n = p_2$, and $E_n = E_2$. For a ring segment p_1 and p_2 are related for equilibrium as follows:

$$p_2 = p_1/k_2 \tag{21}$$

Formulas for the constants β_1, G_1, and M_1 (functions of k_2) are given in Appendix I. M_1 represents a bending moment that causes a bending displacement v as shown in Equation (19b).

Pin Segment

The solution for the pin segment is more complicated due to the pin loading at r_2. The resulting expressions are:

$$\sigma_r = (\sigma_r)_c + \frac{4M_2 p_1}{\beta_1} f_1(r) + g_{m1}(r) \cos m\theta$$

$$\sigma_\theta = (\sigma_\theta)_c + \frac{4M_2 p_1}{\beta_1} f_2(r) + g_{m2}(r) \cos m_\theta \tag{22a-c}$$

$$\tau_{r\theta} = g_{m3}(r) \sin m\theta$$

$$\frac{u}{r} = (u)_c + \frac{M_2 p_1}{E_2 \beta_1} f_3(r) + \frac{G_2 p_1}{r} \cos\theta + \frac{1}{E_2} g_{m4}(r) \cos m\theta \tag{23a, b}$$

$$\frac{v}{r} = \frac{8M_2 p_1}{E_2 \beta_1} (k_2^2 - 1)\,\theta - \frac{G_2 p_1}{r} \sin\theta + \frac{1}{E_2} g_{m5}(r) \sin m\theta$$

where $(\sigma_r)_c$, $(\sigma_\theta)_c$, and $(u)_c$ are again given by Equations (13a-c) and (14a, b) for $k_n = k_2$, $p_{n-1} = p_1$, $p_n = p_2$, and $E_n = E_2$. For a pin segment p_2 is related to p_1 as follows:

$$p_2 = \frac{(m^2-1)(1 + 2\cos\pi/m)}{2(m^2-2)(1 + \cos\pi/m)} \left(\frac{p_1}{k_2}\right) \tag{24}$$

where m defined as

$$m = 2N_s \tag{25}$$

and where N_s is the number of segments per disc.

The functions $f_1(r)$, $f_2(r)$, and $f_3(r)$ are again given by Equations (20a-c) and β_1, G_2, M_2, g_{m1}, ..., $g_{m5}(r)$ are given in Appendix I.

The elasticity solutions now can be used to determine formulas for maximum pressure capability from the fatigue relations. This is done in the next section.