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$$G_2 = \frac{2}{35}\frac{\sqrt{2\Phi}}{\pi} - \frac{1}{6}Y_0 + Y_1$$

$$G_3 = \frac{52}{525}\frac{\sqrt{2\Phi}}{\pi} - \frac{1}{5}Y_0 + \frac{9}{10}Y_1$$

$$G_4 = \frac{316}{2,475}\frac{\sqrt{2\Phi}}{\pi} - \frac{1}{5}Y_0 + \frac{4}{5}Y_1$$

where Y_0 and Y_1 are the solution functions given in A-3500 for the appropriate flaw model and geometry for the component, and Φ is defined in A-3311. When the calculated value for a G_i coefficient is less than 0, the G_i coefficient shall be set to zero for calculating K_I.

(b) For the surface point (Point 2), G_i shall be determined from the following equations:

$$G_0 = F_0$$

$$G_1 = F_1$$

$$G_2 = \frac{4}{105}\frac{\sqrt{\Phi}}{\pi} - \frac{1}{14}F_0 + \frac{5}{7}F_1$$

$$G_3 = \frac{4}{105}\frac{\sqrt{\Phi}}{\pi} - \frac{1}{15}F_0 + \frac{1}{2}F_1$$

$$G_4 = \frac{16}{495}\frac{\sqrt{\Phi}}{\pi} - \frac{3}{55}F_0 + \frac{4}{11}F_1$$

where F_0 and F_1 are the solution functions given in A-3500 for the appropriate flaw model and geometry for the component, and Φ is defined in A-3311. When the calculated value for a G_i coefficient is less than 0, the G_i coefficient shall be set to zero for calculating K_I.

MANDATORY APPENDIX A-3420 K_I BASED ON WEIGHT FUNCTION METHOD

For an arbitrary stress distribution $\sigma(x)$ on crack face, the stress intensity factor is given by the following equation using the weight function method:

$$K_I = \int_0^a m(x,a)\sigma(x)dx \tag{9}$$

where

a = crack depth
K_I = stress intensity factor
$m(x,a)$ = Mode I weight function
x = distance from the surface and moving positive toward the tip of the surface crack, defined in Figure A-3210-1
$\sigma(x)$ = stress distribution normal to the plane of the flaw

A-3421 K_I Equations Based on Weight Functions

(a) For the deepest point (Point 1) of a semielliptical surface crack as shown in Figure A-3100-1, illustration (b), the weight function is given by

$$m(x,a) = \frac{2}{\left[2\pi(a-x)\right]^{1/2}}\left[1 + M_1\left(1-\frac{x}{a}\right)^{1/2} + M_2\left(1-\frac{x}{a}\right) + M_3\left(1-\frac{x}{a}\right)^{3/2}\right]$$

where the weight function coefficients M_j are dependent on geometry of the structure and crack dimensions. The stress intensity factor calculated using A-3420 eq. (9) and the piecewise linear stress distribution of A-3221 eq. (3) is given by