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ANALYTICAL APPROXIMATIONS
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Analytical Approximation

Chi-Square Integral: To better than .0003 over $m \leq \chi^2 < \infty$ and $2 \leq m < \infty$, m being considered a continuous parameter,

$$F_m(\chi^2) = \frac{1}{2\Gamma(\frac{m}{2})} \int_0^{\chi^2} \left(\frac{z}{2}\right)^{\frac{m}{2}-1} e^{-z/2} dz$$

$$\approx 1 - \frac{A}{[1+a_1 t+a_2 t^2+a_3 t^3+a_4 t^4]^4}$$

$$t = \sqrt{\chi^2 - m}$$

$$A = .5 - .1323 \left(\frac{2}{m}\right)^{1/2} - .0036 \left(\frac{2}{m}\right) + .0038 \left(\frac{2}{m}\right)^{3/2}$$

$$a_1 = .2784 + .0783 \left(\frac{2}{m}\right)^{1/2} - .0051 \left(\frac{2}{m}\right)$$

$$a_2 = .2304 - .0247 \left(\frac{2}{m}\right)^{1/2} - .0018 \left(\frac{2}{m}\right)$$

$$a_3 = .0010 + .0592 \left(\frac{2}{m}\right)^{1/2} - .0852 \left(\frac{2}{m}\right) + .0398 \left(\frac{2}{m}\right)^{3/2}$$

$$a_4 = .0781 - .0906 \left(\frac{2}{m}\right)^{1/2} + .0923 \left(\frac{2}{m}\right) - .0366 \left(\frac{2}{m}\right)^{3/2}$$

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