This is the calculation of the fringe radial distance at 90°.

$$r = XC_p$$

$$= 716 * 0.000052 = 0.036763 = 0.0368\, m$$

This is the uncertainty calculation of fringe radial distance.

$$W_r = \sqrt{\left(C_p W_a\right)^2 + \left(X W_{C_p}\right)^2}$$

$$= \sqrt{(0.000052 * 5)^2 + (716 * 0.000001)^2}$$

$$= 0.00076 = \pm 8 * 10^{-4}\, m$$

This is the calculation for the normalized fringe radial distance.

$$X = \frac{r}{a}$$

$$= \frac{0.0368}{0.0115} = 3.213974 = 3.21$$

This is the uncertainty calculation for the normalized fringe radial distance.

$$W_{r/a} = \sqrt{\left(\frac{1}{a} W_r\right)^2 + \left(-\frac{r}{a^2} W_a\right)^2}$$

$$= \sqrt{\left(\frac{1}{0.0115} * 0.0008\right)^2 + \left(-\frac{0.0368}{0.0115^2} * 0.0001\right)^2}$$

$$= 0.075297 = \pm 0.08$$

This is the theory calculation for the hoop stress and radial stress.

$$\sigma_{rr} = \left(\frac{\sigma_n}{2}\right)\left[\left(1 - \frac{a^2}{r^2}\right) + \left(1 - \frac{a^2}{r^2}\right)\left(1 - \frac{3a^2}{r^2}\right)\cos 2\theta\right]$$