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ENGINEERING NOTE

MD [redacted] 1111 | SERIAL M5439 | PAGE 1 OF 1

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PROGRAM — PROJECT — JOB: High-Field Magnet Development

Structural Analysis

TITLE: Deflections of a Thick Ring with Multipole-Magnet-Like Loads.

In a previous note (Ref 1), formulas for stresses were presented for surface normal and shear forces varying as $\cos n\theta$ and $\sin n\theta$. With the stresses known, the deflections can be calculated from the formulas given in (Ref 2), namely:

$$u = \frac{r}{E}\Big\{\left[(-n+2)A_1 r^{n-2} - nB_1 r^n + (n+2)C_1 r^{-n-2} + nD_1 r^{-n}\right] + \nu\left[(-n-2)A_1 r^{n-2} - nB_1 r^n + (n-2)C_1 r^{-n-2} + nD_1 r^{-n}\right]\Big\}\cos n\theta$$

$$v = \frac{r}{E}\Big\{\left[(n+4)A_1 r^{n-2} + nB_1 r^n + (n-4)C_1 r^{-n-2} + nD_1 r^{-n}\right] + \nu\left[n A_1 r^{n-2} + nB_1 r^n + nC_1 r^{-n-2} + nD_1 r^{-n}\right]\Big\}\sin n\theta$$

(Note: These have been translated from the nomenclature used in Ref. 2 into that of Ref. 1 and rearranged. Apparently there is an error in formulas as presented in Ref 2; the stresses, Hook's Law equations, and deflections are not compatible. The above equations are correct.)

The constants $A_1, \cdots, D_1$ are evaluated from the loads using the formulas in Ref. 1

Ref 1 Eng. Note. M5255, Meuser, Oct 23 1978

Ref 2 Handbook of Engineering Mechanics, W. Flügge, 1st. Ed. (1962) pp. 37-17, 18.

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