

For a solid, thin, rotating disc of constant thickness with a radius b , density ρ , and Poisson's ratio ν , the analytical results for the elastic state of stress are summarized below.

1. Governing Equations

For a solid disc, the boundary conditions are $\sigma_r = 0$ at the outer edge ($r = b$) and the displacement $u = 0$ at the center ($r = 0$).

The radial stress (σ_r) and tangential stress (σ_θ) at any radius r are given by:

$$\sigma_r = \frac{3 + \nu}{8} \rho \omega^2 (b^2 - r^2)$$

$$\sigma_\theta = \frac{3 + \nu}{8} \rho \omega^2 b^2 - \frac{1 + 3\nu}{8} \rho \omega^2 r^2$$

2. Maximum Stresses

In a solid disc, both the radial and tangential stresses reach their maximum values at the center ($r = 0$):

$$\sigma_{r,max} = \sigma_{\theta,max} = \frac{3 + \nu}{8} \rho \omega^2 b^2$$

3. Radial Displacement

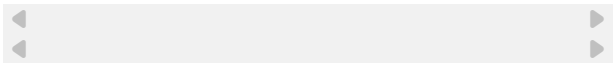
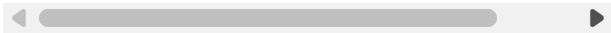
The radial displacement u at a distance r from the center is:

$$u = \frac{\rho \omega^2 r}{8E} [(3 + \nu)(1 - \nu)b^2 - (1 - \nu^2)r^2]$$



Summary Table for Export

Parameter	Formula
Radial Stress (σ_r)	$\frac{3+\nu}{8}\rho\omega^2(b^2 - r^2)$
Tangential Stress (σ_θ)	$\frac{3+\nu}{8}\rho\omega^2b^2 - \frac{1+3\nu}{8}\rho\omega^2r^2$
Max Stress (at $r = 0$)	$\frac{3+\nu}{8}\rho\omega^2b^2$
Radial Displacement (u)	$\frac{\rho\omega^2r}{8E}[(3 + \nu)(1 - \nu)b^2 - (1 - \nu^2)r^2]$



Note: These results assume plane stress conditions ($t \ll b$), which is standard for thin disc analysis in structural mechanics.

Would you like me to generate a Python script to calculate and plot these stress distributions for your XdTd project?

I have that already. Just need
the formulas

Below are the analytical formulas for a
solid rotating disc of constant thickness,
presented in a clean, structured format
that is easily captured or exported to PDF
for your documentation.

Analytical Formulas for a Solid Rotating Disc

For a solid disc of radius b , density ρ ,
Poisson's ratio ν , and constant angular
velocity ω :

1. Stress Components

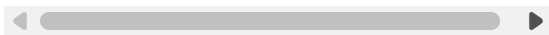
The radial and tangential stresses at any
radius r ($0 \leq r \leq b$) are defined as:

- **Radial Stress (σ_r):**

$$\sigma_r(r) = \frac{3 + \nu}{8} \rho \omega^2 (b^2 - r^2)$$

- **Tangential Stress (σ_θ):**

$$\sigma_\theta(r) = \frac{3 + \nu}{8} \rho \omega^2 b^2 - \frac{1 + 3\nu}{8} \rho \omega^2 r^2$$



2. Maximum Values (at the Center, $r = 0$)

At the center of a solid disc, the radial and
tangential stresses are equal and reach

their maximum value:

$$\sigma_{max} = \sigma_r(0) = \sigma_\theta(0) = \frac{3 + \nu}{8} \rho \omega^2 b^2$$

3. Radial Displacement

The radial displacement u at any radius r , where E is Young's Modulus:

$$u(r) = \frac{\rho \omega^2 r}{8E} [(3 + \nu)(1 - \nu)b^2 - (1 - \nu^2)r^2]$$



Summary Table for Reference

Parameter	Formula
Radial Stress	$\sigma_r = \frac{3+\nu}{8} \rho \omega^2 (b^2 - r^2)$
Tangential Stress	$\sigma_\theta = \frac{3+\nu}{8} \rho \omega^2 b^2 - \frac{1+\nu}{8} \rho \omega^2 r^2$
Displacement	$u = \frac{\rho \omega^2 r}{8E} [(3 + \nu)b^2 - (1 - \nu^2)r^2]$

