

Crack Between Neo-Hookean Material and Rigid Body - Pre-Analysis & Start-up

Authors: Tianshu Liu and Chia-Hsun Hsieh, Cornell University

[Problem Specification](#)

[1. Pre-Analysis & Start-Up](#)

[2. Geometry](#)

[3. Mesh](#)

[4. Physics Setup](#)

[5. Numerical Solution](#)

[6. Numerical Results](#)

[7. Verification & Validation](#)

[Exercises](#)

[Comments](#)

Pre-Analysis & Start-Up

The linear elastic crack solutions for the stress near the crack tip are:

$$\sigma_r = \frac{K_I}{\sqrt{2\pi r}} \left(\frac{5}{4} \cos \frac{\theta}{2} - \frac{1}{4} \cos \frac{3\theta}{2} \right);$$

$$\sigma_\theta = \frac{K_I}{\sqrt{2\pi r}} \left(\frac{3}{4} \cos \frac{\theta}{2} + \frac{1}{4} \cos \frac{3\theta}{2} \right);$$

$$\tau_{r\theta} = \frac{K_I}{\sqrt{2\pi r}} \left(\frac{1}{4} \sin \frac{\theta}{2} + \frac{1}{4} \sin \frac{3\theta}{2} \right)$$

Three linear elastic crack solutions for the displacement near the crack tip are:

$$u_r = \frac{K_I}{4\mu} \sqrt{\frac{r}{2\pi}} \left[(2\kappa - 1) \cos \frac{\theta}{2} - \cos \frac{3\theta}{2} \right];$$

$$u_\theta = \frac{K_I}{4\mu} \sqrt{\frac{r}{2\pi}} \left[-(2\kappa + 1) \sin \frac{\theta}{2} + \sin \frac{3\theta}{2} \right]$$

where r is the radial direction and θ is the circumferential direction. The value for both μ and K is $1e6$.

Start-Up

[Go to Step 2: Geometry](#)

[Go to all ANSYS Learning Modules](#)