

Chapter 02.02

Physical Problem for Differentiation

To find the stress concentration around a hole in a plate under a uniform stress, a finite difference program has been written that calculates the radial and tangential displacements at different points in the plate. To find the stresses and hence the stress concentration factor, one needs to find the derivatives of these displacements. Below are given the radial displacements, u along the y-axes.

- a) At $x = 0$ if the radial strain, ε_r is given by $\varepsilon_r = \frac{\partial u}{\partial r}$, find the radial strain at $r = 1.1\text{cm}$ Using the third order polynomial interpolant for calculating radial strain.
- b) If the tangential strain at $r = 1.1\text{cm}, \theta = 90^\circ$ is given to you as $\varepsilon_\theta = 0.0029733$, find the hoop stress, σ_θ , at $r = 1.1\text{cm}, \theta = 90^\circ$ if $\sigma_\theta = \frac{E}{1-\nu^2}(\varepsilon_r + \nu\varepsilon_\theta)$

$r(\text{cm})$	$u(\text{cm})$
1.0	-0.0010000
1.1	-0.0010689
1.2	-0.0011088
1.3	-0.0011326
1.4	-0.0011474
1.5	-0.0011574
1.6	-0.0011650
1.7	-0.0011718
1.8	-0.0011785
1.9	-0.0011857

Differentiation	
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