Theory of Elasticity ME 6102 **National University of Singapore**

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Assignment # 8

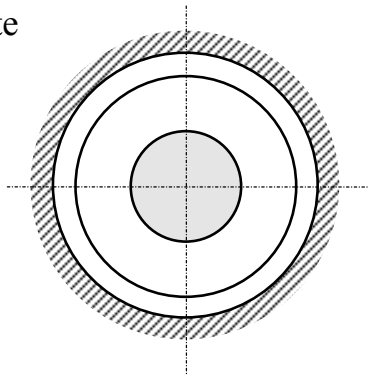
1. A circular disk of inner radius *a* and outer radius *b* is shrunk onto a shaft of outer radius a +δ, made of the same material. The shaft rotates in a cylindrical cavity. At rest, the clearance between the disk and the cavity is Δ.

   (a) Determine the value of δ for which the disk will separate from the shaft upon touching the cavity wall.

   (b) For the value of δ calculated in (a), what is the maximum shear stress in the disk when it rotates at a *1/3* of the angular velocity calculated in (a).

   Data: $\rho = 7.8 gr/cm^3 ; \nu = 0.3; E = 2.1 \cdot 10^6 Kg/cm^2$

   $a = 5\,cm;\ b = 20\,cm;\ \Delta = 0.02\,cm$



2. The contour of the cross section of a shaft subjected to torsion, is determined by the following functions: boundaries *AC* and *BD* by: $a^2 - x^2 + cy^2 = 0$; and boundaries *AB* and *CD* by $a^2 - y^2 + cx^2 = 0$. The twisting moment is M_T and the outer surface of the shaft is free of external tractions.

   (a) Suggest a stress function for the solution of this problem of the form $\psi = A \cdot f(x,y)$, that satisfies the proper boundary conditions. Determine *A* and *C* so that $\nabla^2\psi = -2$.

   (b) Evaluate the stress field within the shaft and The stress at points *B* and *E*.

