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TAKE HOME EXAM 1

ECE 431. Homework 5

Due March 3, 1996

Problem 5-1: Show that for the TM modes of an arbitrary waveguide, the governing integral equation for the mode is given by:
(a)

$$0 = \int_C dl' g(\mathbf{r}-\mathbf{r}') \frac{\partial \psi_h(\mathbf{r}')}{\partial n'}, \quad \mathbf{r} \in C.$$

(b) Discretize the integral equation using pulse basis function, and derive a determinental equation from which you can find the modes of the hollow wavguide. You can use the Muller root solver to find the roots of the determinental equation. Check your code with the first two modes of a circular waveguide. (I can provide programs for Hankel function, and also the Muller root solver. For the self-term of the matrix element, you can evaluate it with the small argument approximation of the Hankel function [see Harrington, *Field Computation by Moment Method*, p. 42, for example]. For the far term, you can use the point source approximation.)