

In the name of God

Department of Physics  
Shahid Beheshti University

COMPUTATIONAL PHYSICS

Exercise Set 5

(Date Due: 1393/08/15)

1. Finite difference method:

For a thick pressure vessel of inner radius  $a = 1m$  and outer radius  $b = 5m$ , the differential equation for the radial displacement  $y$  of a point along the thickness is given by:

$$\frac{d^2y}{dr^2} + \frac{1}{r} \frac{du}{dr} - \frac{u}{r^2} = 0$$

suppose that  $u(r = a) = 1$  and  $u(r = b) = 10$ . Using the finite difference method with  $\Delta r = 1$  compute the radial displacement as a function of  $r$ .

2. Finite Element method:

Suppose we have following differential equation:

$$-y''(x) + y(x) = f(x)$$

$x \in [0, 1]$  and  $f(x) = 1$ . The boundary conditions are  $y(0) = y(1) = 0$ . Using the following basis function:

$$u_i(x_j) = \delta_{ij}$$

solve above differential equation using finite element method. To check your result, at first chose  $\Delta x = 1/4$  so in this case you have 3 parts. Finally chose more small step and using a computer program find the result.

Good luck, Movahed

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