MEEN 673 **Spring Semester 2023**

Nonlinear Finite Element Analysis

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ASSIGNMENT No. 4

Time-dependent nonlinear analysis of 2-D single-variable problems

Date: 27 Feb 2023 **Due: 5pm on Friday, 10th Mar 2023**

Extend the 2-D nonlinear finite element computer program in a single variable (PROGRAM 3) to analyze time-dependent problems described by equations of the form

$$c_1\frac{\partial u}{\partial t}+c_2\frac{\partial^2 u}{\partial t^2}-\frac{\partial}{\partial x}\left(a_{11}\frac{\partial u}{\partial x}\right)-\frac{\partial}{\partial y}\left(a_{22}\frac{\partial u}{\partial y}\right)+a_{00}u=f(x,y,t) \quad \text{in} \quad \Omega$$

where c_1 and c_2 are, in general, functions of x and y only. Other data, a_{ij}, is as described in PROGRAM 3 (i.e., nonlinear functions of u and its first derivatives). You have plenty of program help through **Box 6.7.1** and **Box 6.7.2** on pages 296–299 of the text book. Verify your code using the problems in **Examples 6.7.1 and 6.7.3**. Then submit your any notes on the problems and the plots included in Figures 6.7.5, 6.7.6, and 6.7.10 of the textbook to me via email.