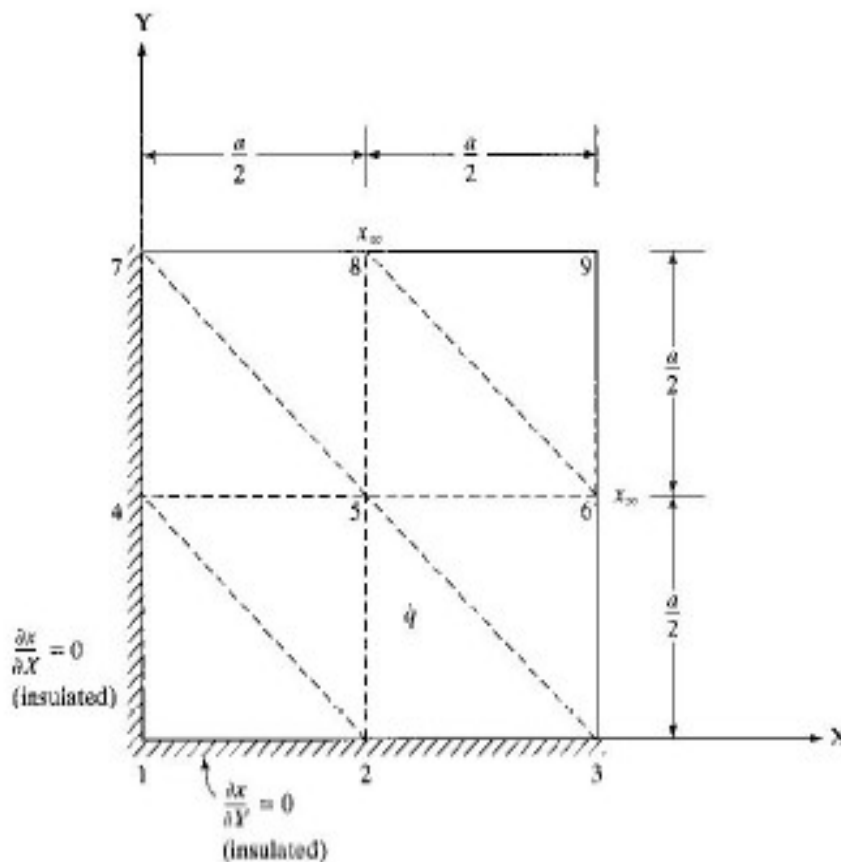


MAT-202E NUMERICAL METHODS HOMEWORK 2

Due date for source code submission via e-mail: 02.11.2008 12 pm
Due date for the submission of the report: 03.11.2008

Write a computer program (in MATLAB, FORTRAN or C/C++) that will solve a system of linear algebraic equations using the “iterative Gauss-Siedel method with relaxation”. The program is to read the coefficient matrix and right hand side vector from a user specified input file in ASCII format. It should then check for the diagonal dominance of the system. Solve the system and output the results. Tolerance value, number of maximum iterations and relaxation parameter should be the arguments of this function. Using this program solve the following heat transfer problem.

Two sides of a square plate with uniform internal heat generation are insulated as per the below figure. Other two sides are kept at a constant temperature of x_{inf} . Heat conduction analysis using a finite element method with the shown grid leads to the following linear system of equations. Here x_i denotes the temperature at the i^{th} node. $q=150 \text{ W/cm}^2$ is the rate of internal heat generation, $a=20 \text{ cm}$ is the length of one side of the plate and $k=50 \text{ W/cm}$ is the thermal conductivity of the plate.



$$\begin{bmatrix} 2 & -1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ -1 & 4 & 0 & 0 & -2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 4 & -2 & 0 & 0 & 0 & 0 \\ 0 & -2 & 0 & -2 & 8 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \end{pmatrix} = \frac{qa^2}{12k} \begin{pmatrix} 1 \\ 3 \\ 0 \\ 3 \\ 6 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} + x_\infty \begin{pmatrix} 0 \\ 1 \\ 1 \\ 1 \\ 4 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

Homework Rules

You should present your own work during the course. Any unethical behaviour shall be penalized seriously.

You will post your homework in a zip file named as 'HW1-ID#.zip' to the address

tuncero@itu.edu.tr

The zip file should include the necessary source codes and executables (m-files, FORTRAN codes, etc.)

Homework Format

Homework should consist of the following parts. Problem Definition and Discussion and Conclusion parts should be typed up using a word processor software. Neatness counts.

1. Cover Page (The cover page should state the name and ID number of the student clearly, cover page also needs to include the course name and homework number)

In addition, cover page must also include the following statement at the bottom;

“I have neither given nor received any unauthorized help for this assignment”

Your Signature

2. Problem Definition
3. Results (In Numerical or Graphical Format)
4. Discussion
5. Appendix (Source Code, etc.)

Source code should include the necessary comments and results should be presented with at least 5 digits.