Numerical Exercise 2
Advanced Engineering Mathematics (ME 501)
Department of Mechanical Engineering
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Solving a system of simultaneous linear equations by Gauss-Seidel technique

In majority of applications, the techniques (or approximations) that result continuous equation(s) into discrete linear equations introduce numerical errors. Thus, solving these linear equations to a desired level of accuracy is justified. The methods where this idea is kept as central theme is known as the "iterative method". Almost all iterative techniques start with a guess solution which is usually far from the actual solution and it is corrected (or modified) repeatedly until we reach a stage where error is below the acceptable level.

Remember the following points while writing the program for the Gauss-Seidel technique for the system $Ax = b,\ A \in \boldsymbol{R^{n \times n}},\ x \in \boldsymbol{R^n},\ b \in \boldsymbol{R^n}$

- One **NEED NOT** store the entries of A which are zero.
- During a particular iteration only the latest available value for an unknown should be used.
- The diagonal entry can not be zero. In case it appears row exchange is mandatory..
- The solution x is required to be written in a output file.
- In the algorithm (see overleaf), use $\epsilon = 10^{-6}$.
- Check with the system

$$\begin{aligned} 3.2x_1 + 1.6x_2 &= -0.8 \\ 1.6x_1 - 0.8x_2 + 2.4x_3 &= 16 \\ 2.4x_2 - 4.8x_3 + 3.6x_4 &= -39 \\ 3.6x_3 + 2.4x_4 &= 10.2 \end{aligned}$$

  which has the solution$x_1 = 1.5, x_2 = -3.5, x_3 = 4.5, x_4 = -2.5$.

- The efforts and time required for the Gauss elimination and the present method.

IDEAS FROM FIRST TWO LAB ASSIGNMENTS WILL HELP US SOLVING A POISSON EQUATION WHICH IS THE NEXT