

Linear System (2)

Solving linear system plays a key role in many scientific application, such as engineering, physics, chemistry, computer science, and economics.

Example

The solution of the linear system $\mathbf{Ax} = \mathbf{b}$ can be retrieved as

$$\mathbf{Ly} = \mathbf{Pb}$$

$$\mathbf{Ux} = \mathbf{y}$$

by exploiting the PALU decomposition of \mathbf{A} or throughout its QR decomposition as

$$\mathbf{Q}' \mathbf{y} = \mathbf{b}$$

$$\mathbf{R} \mathbf{x} = \mathbf{y}$$

Requirements

Write a software able to compute the linear system solution with PALU and QR decomposition of the following systems:

1. $\mathbf{A} = [5.547001962252291\text{e-}01, -3.770900990025203\text{e-}02; 8.320502943378437\text{e-}01, -9.992887623566787\text{e-}01]$ $\mathbf{b} = [-5.169911863249772\text{e-}01; 1.672384680188350\text{e-}01]$
2. $\mathbf{A} = [5.547001962252291\text{e-}01, -5.540607316466765\text{e-}01; 8.320502943378437\text{e-}01, -8.324762492991313\text{e-}01]$ $\mathbf{b} = [-6.394645785530173\text{e-}04; 4.259549612877223\text{e-}04]$
3. $\mathbf{A} = [5.547001962252291\text{e-}01, -5.547001955851905\text{e-}01; 8.320502943378437\text{e-}01, -8.320502947645361\text{e-}01]$ $\mathbf{b} = [-6.400391328043042\text{e-}10; 4.266924591433963\text{e-}10]$

All the three system shall have solution $\mathbf{x} = [-1.0\text{e}+0; -1.0\text{e}+00]$

Check for each system the relative error.