

LU-decomposition

General description
 - partial pivoting / only row
 - $A \in \mathbb{R}^{n \times n}$
 - L - lower triangular
 - U - upper triangular
 - P - permutation matrix

$$A \rightarrow U = \begin{bmatrix} u_{11} & u_{12} & \dots & u_{1n} \\ 0 & u_{22} & \dots & u_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & u_{nn} \end{bmatrix}$$

$n \rightarrow$ no pivoting on
 - choose u_{ii} (if $i \leq n-i$)
 - divide A_{ij} by u_{ii}
 - u_{ii} is u_{ii} (if $i > n-i$)
 - already reduced to zero
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[Do not reduce u_{ii} to 1]

$$\begin{bmatrix} u_{11} & u_{12} & \dots & u_{1n} \\ 0 & u_{22} & \dots & u_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & u_{nn} \end{bmatrix}$$

Block-substitution

$$u_{11} = u_{11} \rightarrow u_{11} = u_{11}$$

$$u_{11} = \frac{1}{u_{11}} [u_{11} - u_{11}^2 u_{11}^{-1}]$$

LU-decomposition (Block-substitution)

$$\begin{bmatrix} u_{11} & 0 & 0 & 0 \\ u_{21} & u_{22} & 0 & 0 \\ u_{31} & u_{32} & u_{33} & 0 \\ u_{41} & u_{42} & u_{43} & u_{44} \end{bmatrix}$$

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