Module 3 - Systems of Linear Equations

ME3001 - Mechanical Engineering Analysis

Mechanical Engineering

Tennessee Technological University

Topic 2 - Matrix Multiplication

Topic 2 - Matrix Multiplication

- Motivation
- Multiplication of Conformible Matrices
- Generalized Description of Multiplication
- Exercise in MATLAB

Motivation

- Why do we need to multiply matrices?

- Why do we need to use a computer?

Multiplication of Conformible Matrices

Consider 2 conformable matrices F and G with elements f_{ij} and g_{ij}. Matrix Multiplication gives the product matrix E with elements e_{ij}.

$$E = F \times G \qquad e_{ij} = \Sigma_{k=1}^{n} f_{ik} \times g_{kj}$$

$$\begin{bmatrix} e_{11} & e_{12} \\ e_{21} & e_{22} \end{bmatrix} = \begin{bmatrix} f_{11} & f_{12} & f_{13} \\ f_{21} & f_{22} & f_{23} \end{bmatrix} \times \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \\ g_{31} & g_{32} \end{bmatrix}$$

Generalized Description of Multiplication

$$e_{ij} = \sum_{k=1}^{n} f_{ik} \times g_{kj}$$

$$\left[\begin{array}{cc} e_{11} & e_{12} \\ \\ e_{21} & e_{22} \end{array}\right] = \left[\begin{array}{c|c} f_{11}g_{11} + f_{12}g_{21} + f_{13}g_{31} & f_{11}g_{12} + f_{12}g_{22} + f_{13}g_{32} \\ \\ f_{21}g_{11} + f_{22}g_{21} + f_{23}g_{31} & f_{21}g_{12} + f_{22}g_{22} + f_{23}g_{32} \end{array}\right]$$

- What does that equation above mean?
- How can we write a *General Solution Technique* using the equation?

Generalized Description of Multiplication

A Programming Exercise - Matrix Multiplication