Metoda Numerik

Aplikasi di Lapangan: Kuda-kuda Sederhana

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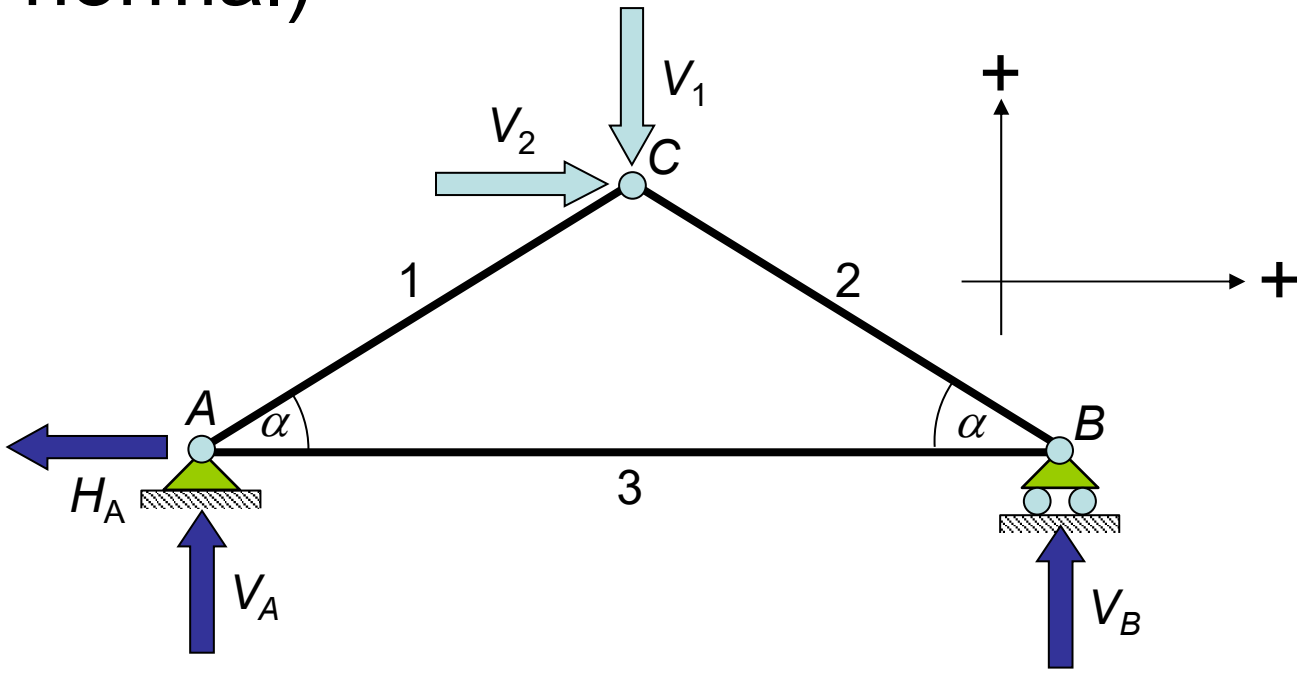
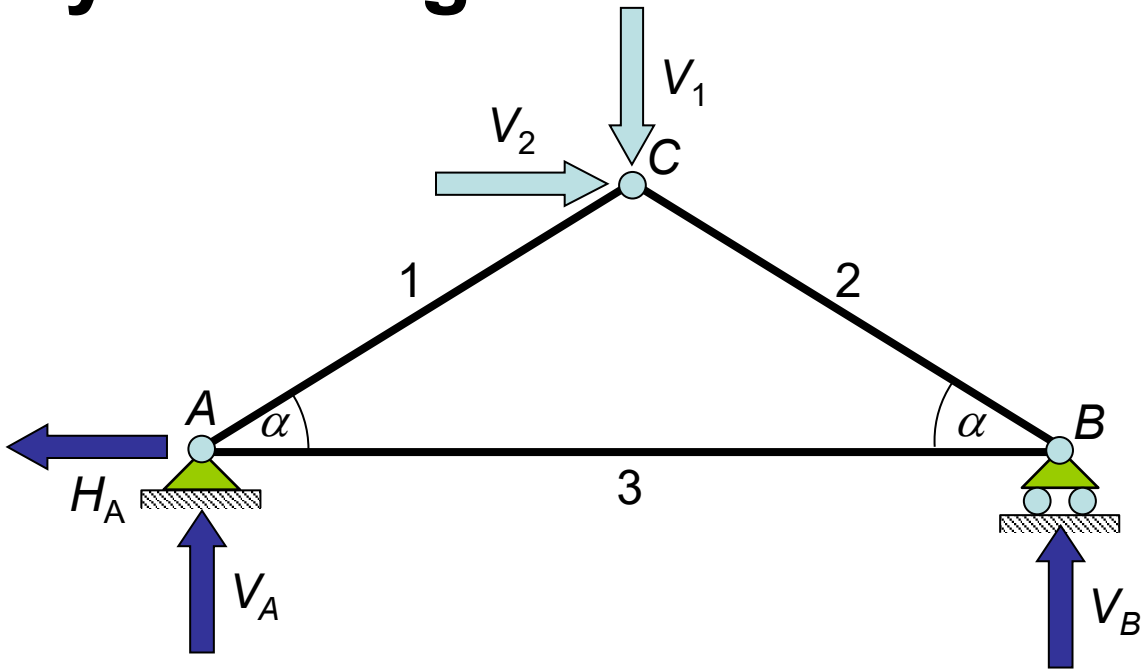
Kuda-kuda Sederhana

- Sebuah kuda-kuda sederhana menahan beban luar (dalam kondisi normal)



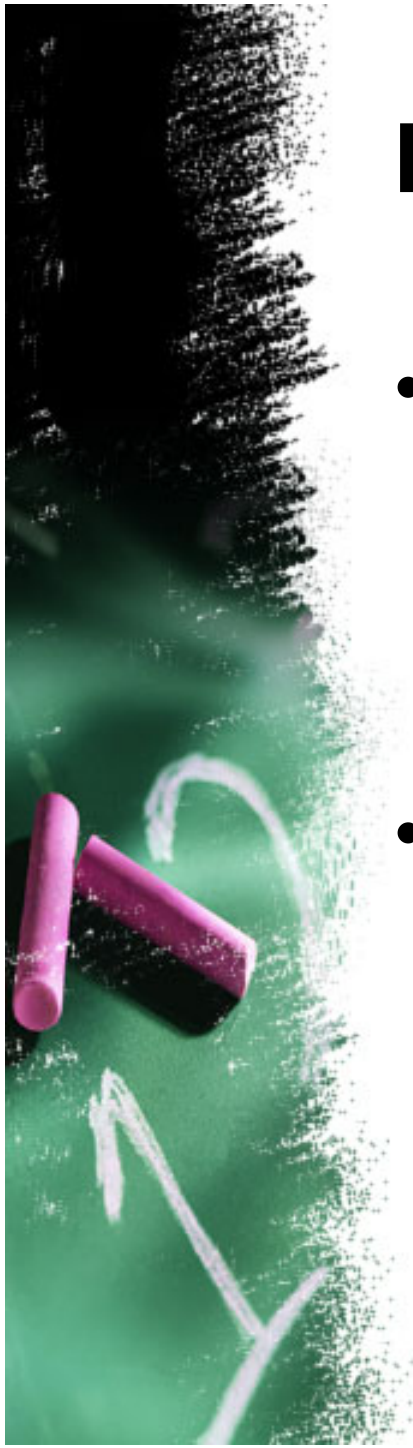
Hitungan Reaksi Perletakan dan Gaya Batang



- Reaksi perletakan dihitung dengan cara:
  - $\Sigma F_H = 0$, $\Sigma F_V = 0$, $\Sigma M_A = 0$

Hitungan Reaksi Perletakan

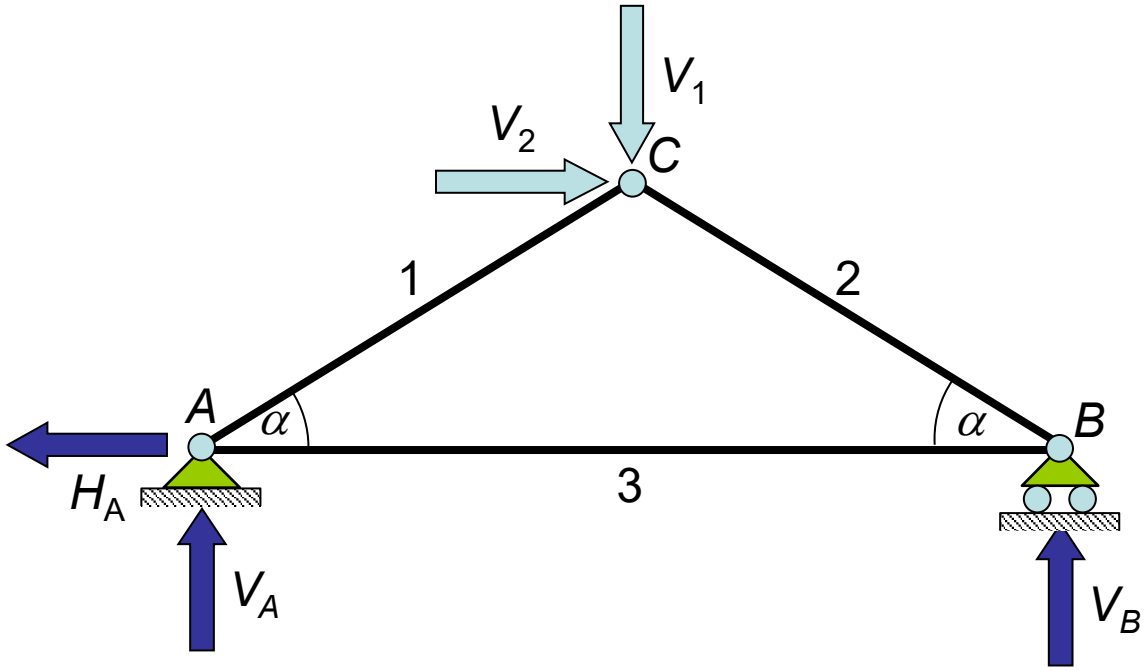
- Reaksi perletakan dihitung dengan cara:
  - $\Sigma F_H = 0 \rightarrow H_A = V_2$
  - $\Sigma F_V = 0 \rightarrow V_A + V_B = V_1$
  - $\Sigma M_A = 0$
    - $V_1 L_3/2 + V_2 L_3/2 \tan \alpha - V_B L_3 = 0$
    - $2V_B = V_1 + V_2 \tan \alpha$



Hitungan Gaya Batang 1 & 2

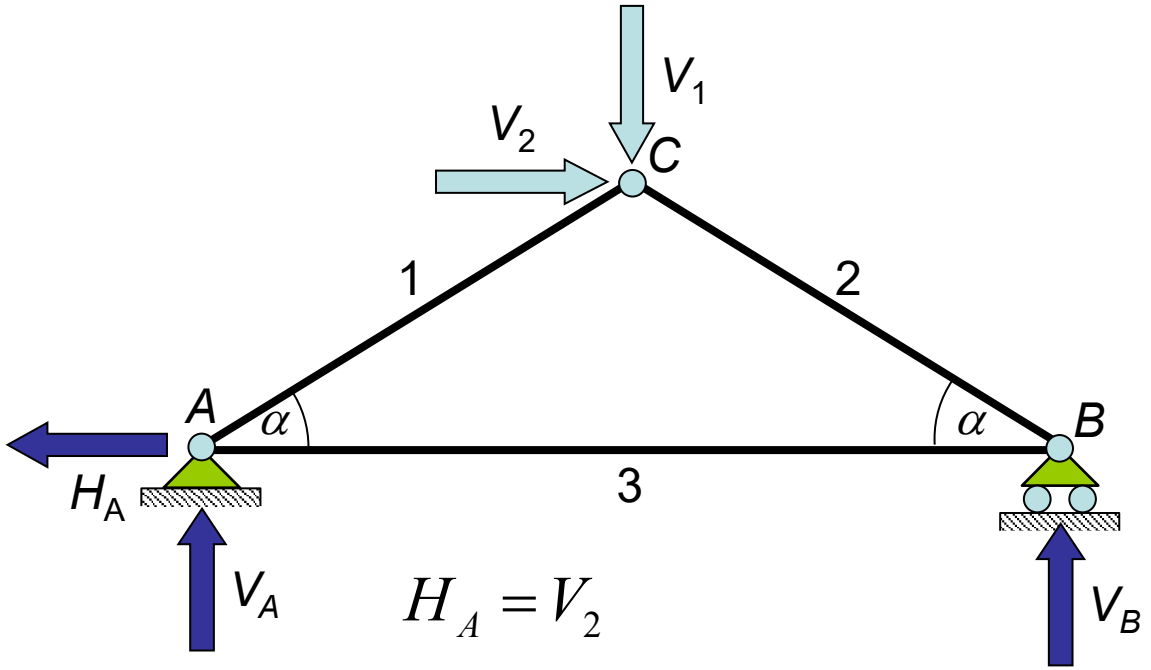
- Titik buhul *A*:
  - $\Sigma F_V = 0 \rightarrow V_A - P_1 \sin \alpha = 0$
  - $\Sigma F_H = 0 \rightarrow - H_A - P_1 \cos \alpha - P_3 = 0$
- Titik buhul *B*:
  - $\Sigma F_V = 0 \rightarrow V_B - P_2 \sin \alpha = 0$
  - $\Sigma F_H = 0 \rightarrow P_2 \cos \alpha + P_3 = 0$

Hitungan Gaya Batang 2



- Titik buhul *C*:
  - $\Sigma F_V = 0 \rightarrow P_1 \sin \alpha + P_2 \sin \alpha = V_1$
  - $\Sigma F_H = 0 \rightarrow -P_1 \cos \alpha + P_2 \cos \alpha = V_2$

Sistem persamaan yang terjadi



$$H_A = V_2$$

$$V_A + V_B = V_1$$

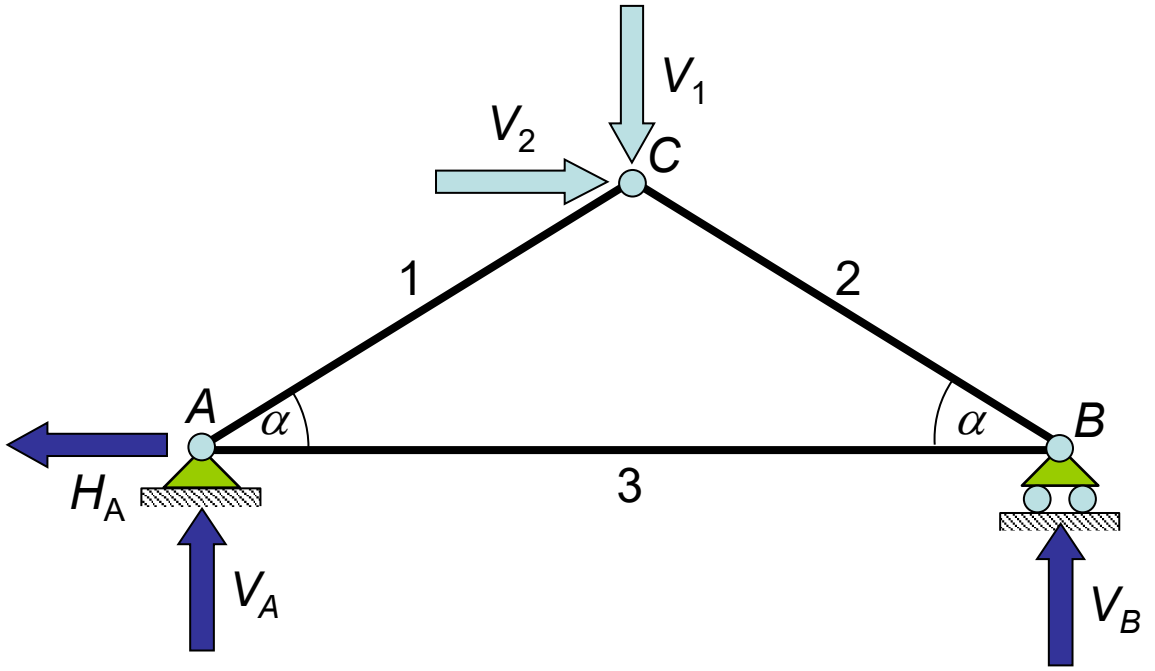
$$2V_B = V_1 + V_2 \tan\alpha$$

$$P_1 + P_2 = V_1 \csc\alpha$$

$$-P_1 + P_2 = V_2 \sec\alpha$$

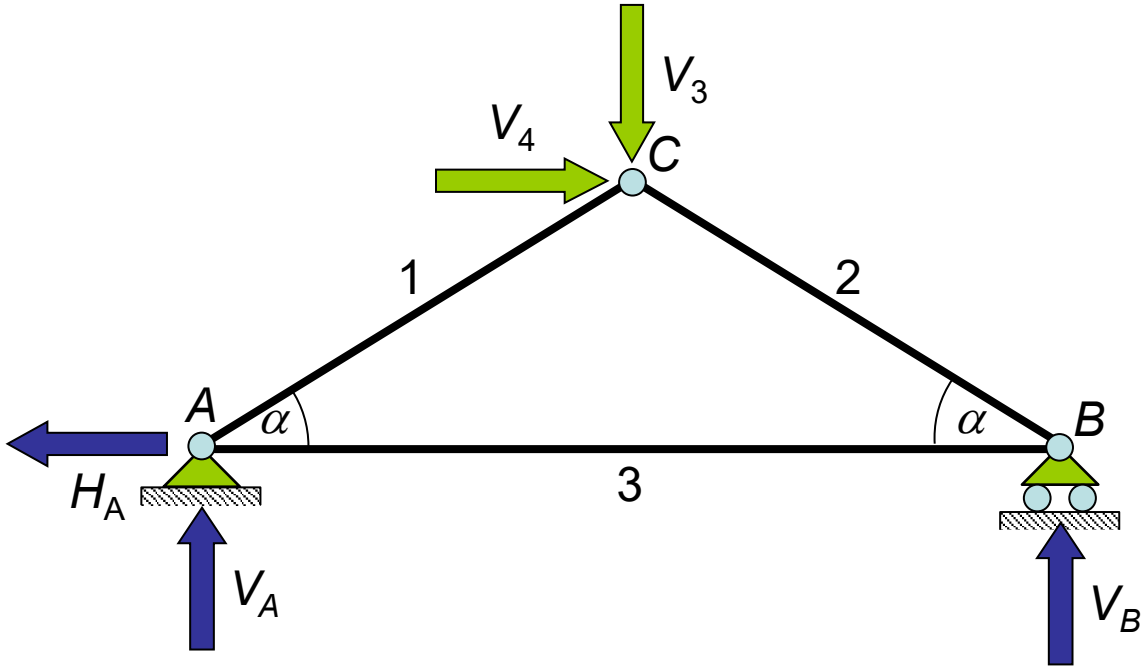
$$\cos\alpha P_1 + P_3 = 0$$

Dalam bentuk matriks



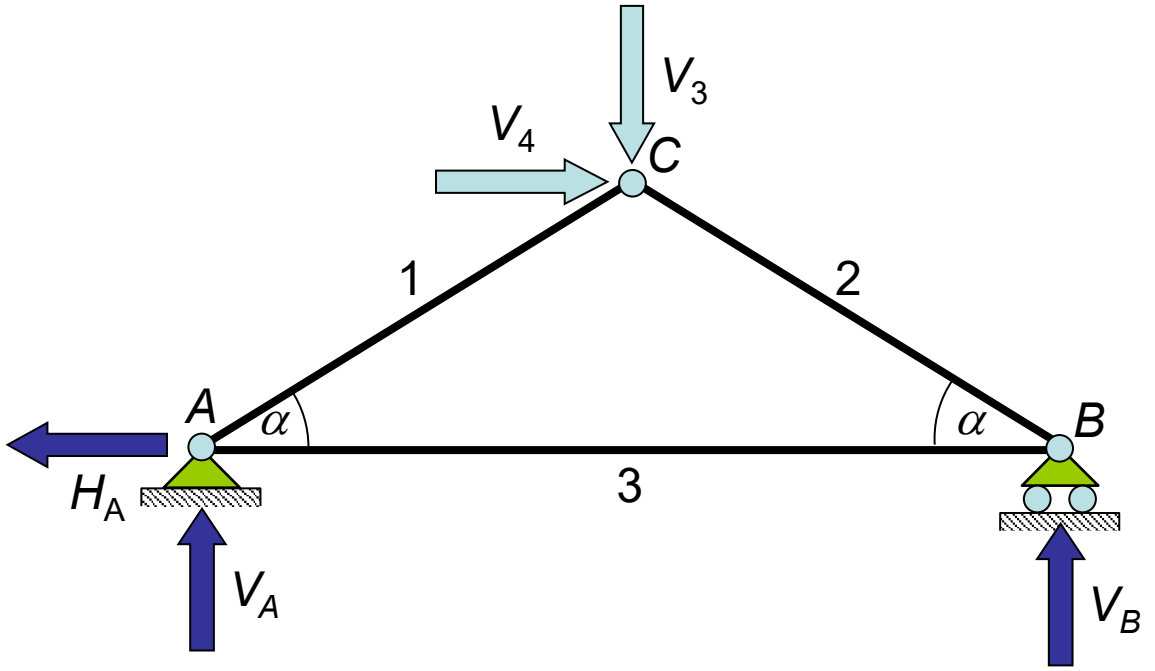
$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & \cos\alpha & 1 \end{bmatrix} \begin{Bmatrix} H_A \\ V_A \\ V_B \\ P_1 \\ P_2 \\ P_3 \end{Bmatrix} = \begin{Bmatrix} V_2 \\ V_1 \\ V_1 + V_2 \tan\alpha \\ V_1 \csc\alpha \\ V_2 \sec\alpha \\ 0 \end{Bmatrix}$$

Gaya Luar Berubah



- Jika gaya luar V_3 dan V_4 berubah, maka yang berubah hanya vektor kanan dari gaya luar.

Dalam bentuk matriks



$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & \cos\alpha & 1 \end{bmatrix} \begin{Bmatrix} H_A \\ V_A \\ V_B \\ P_1 \\ P_2 \\ P_3 \end{Bmatrix} = \begin{Bmatrix} V_4 \\ V_3 \\ V_3 + V_4 \tan\alpha \\ V_3 \csc\alpha \\ V_4 \sec\alpha \\ 0 \end{Bmatrix}$$