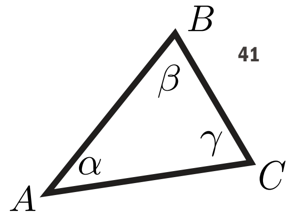
Exemple de triangle en compensation paramétrique



- Modèles
  - générale $\ell - \mathbf{v} = f(\mathbf{x})$
  - linéaire $(\ell - \mathbf{a}_0) - \mathbf{v} = \mathbf{A}\mathbf{x}$
- Choix
  - 2 paramètres indépendants, p. ex. $\alpha,\ \beta$

$$
\begin{aligned}
\check{\ell}_\alpha \quad &= \check{\alpha} &&= f_1(\check{\alpha}, \check{\beta}) \\
\check{\ell}_\beta \quad &= \check{\beta} &&= f_2(\check{\alpha}, \check{\beta}) \\
\check{\ell}_\gamma - 200 &= -(\check{\alpha} + \beta) &&= f_3(\check{\alpha}, \check{\beta})
\end{aligned}
$$

  - Vecteur - matrice

$$
\begin{bmatrix} \ell_\alpha \\ \ell_\beta \\ \ell_\gamma \end{bmatrix} - \underbrace{\begin{bmatrix} \cdot \\ \cdot \\ 200 \end{bmatrix}}_{\mathbf{a}_0} - \begin{bmatrix} v_\alpha \\ v_\beta \\ v_\gamma \end{bmatrix} = \underbrace{\begin{bmatrix} +1 & \cdot \\ \cdot & +1 \\ -1 & -1 \end{bmatrix}}_{\mathbf{A}} \underbrace{\begin{bmatrix} \alpha \\ \beta \end{bmatrix}}_{\mathbf{x}}
$$

EPFL

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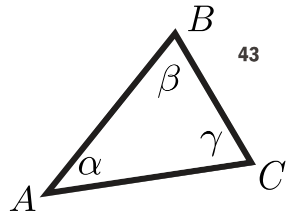
$$\ell_\alpha = 035.471\,\text{gon}$$
$$\ell_\beta = 107.383\,\text{gon}$$
$$\ell_\gamma = 057.122\,\text{gon}$$



$$\mathbf{P} = \mathbf{I}_3$$

$$\begin{bmatrix} \ell_\alpha \\ \ell_\beta \\ \ell_\gamma \end{bmatrix} - \underbrace{\begin{bmatrix} \cdot \\ \cdot \\ 200 \end{bmatrix}}_{\mathbf{a}_0} - \begin{bmatrix} v_\alpha \\ v_\beta \\ v_\gamma \end{bmatrix} = \underbrace{\begin{bmatrix} +1 & \cdot \\ \cdot & +1 \\ -1 & -1 \end{bmatrix}}_{\mathbf{A}} \underbrace{\begin{bmatrix} \alpha \\ \beta \end{bmatrix}}_{\mathbf{x}}$$

- Solution numérique
  - réduction $\ell_\gamma - 200 = -142.878$
  - eq. normales $\mathbf{N} = \mathbf{A}^T\mathbf{A} = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$
  - inverse $\mathbf{N}^{-1} = \frac{1}{3}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$
  - paramètres $\mathbf{N}^{-1}\mathbf{A}^T(\ell - a_0) = \begin{bmatrix} \frac{2}{3} & -\frac{1}{3} \\ -\frac{1}{3} & \frac{2}{3} \end{bmatrix} \begin{bmatrix} 178.349 \\ 250.261 \end{bmatrix}$

$$\hat{\mathbf{x}} = \begin{bmatrix} 35.479 \\ 107.391 \end{bmatrix}$$

- .
  - résidus $\hat{\mathbf{v}} = (\ell - \mathbf{a}_0) - \mathbf{A}\hat{\mathbf{x}}$

$$= \begin{bmatrix} -0.008 \\ -0.008 \\ -0.008 \end{bmatrix}$$

  - obs. compensées

$$\hat{\ell} = \ell - \hat{\mathbf{v}} = \begin{bmatrix} 35.479 \\ 107.391 \\ 57.130 \end{bmatrix}$$