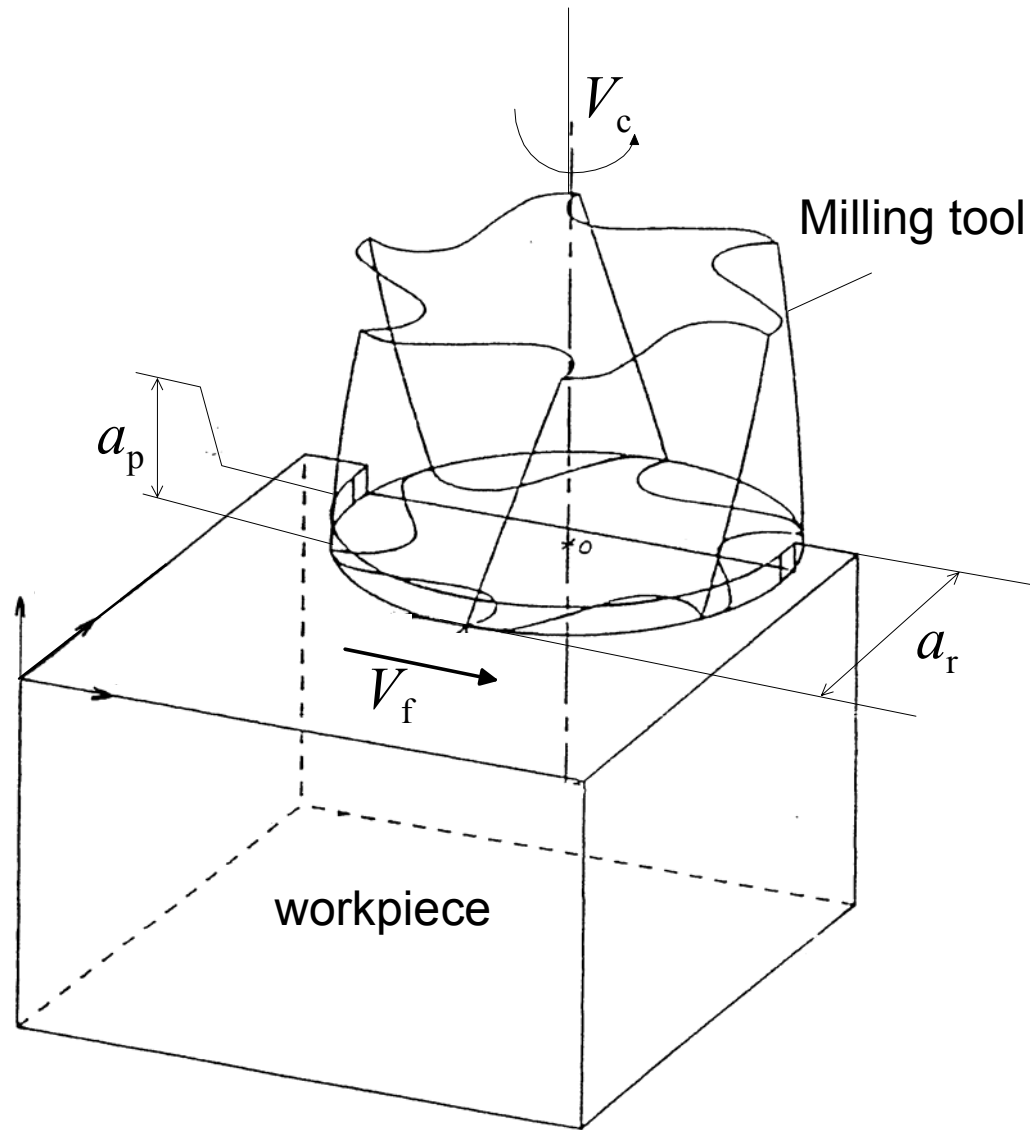
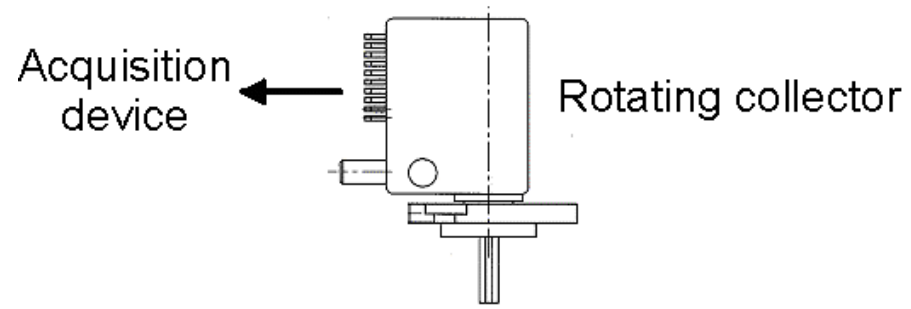
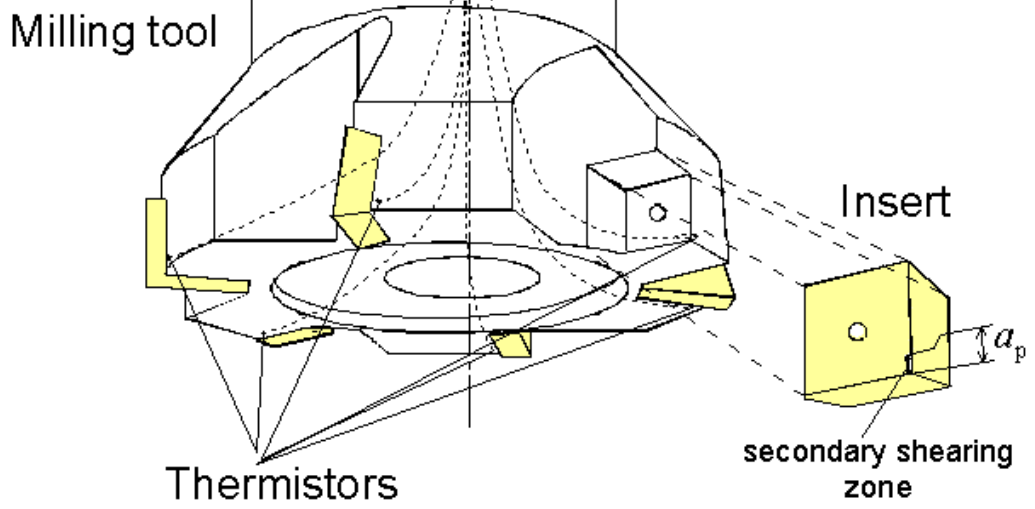
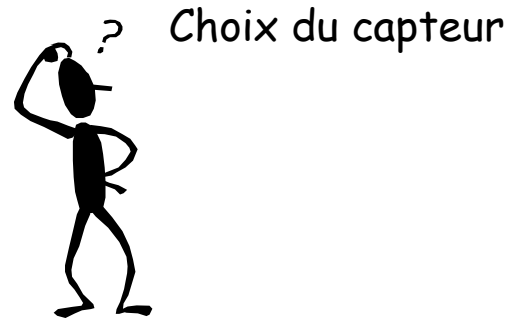


Application à l'estimation de flux dans un outil de fraisage
Approche multivariable

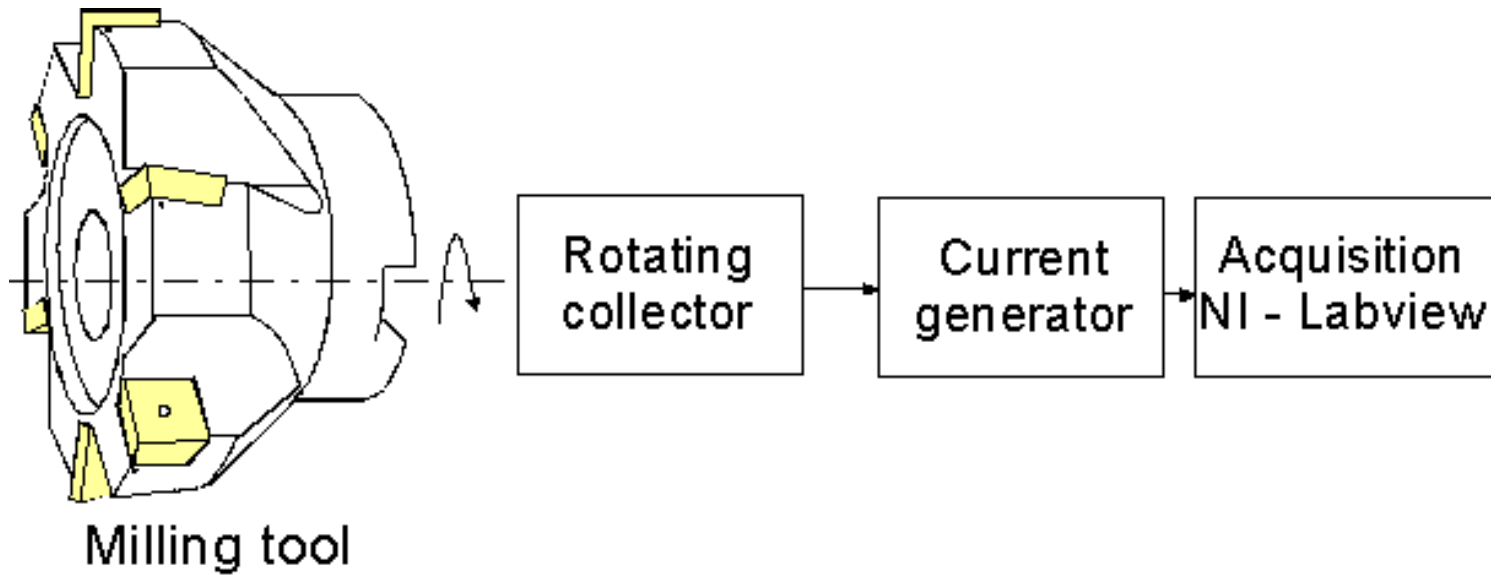




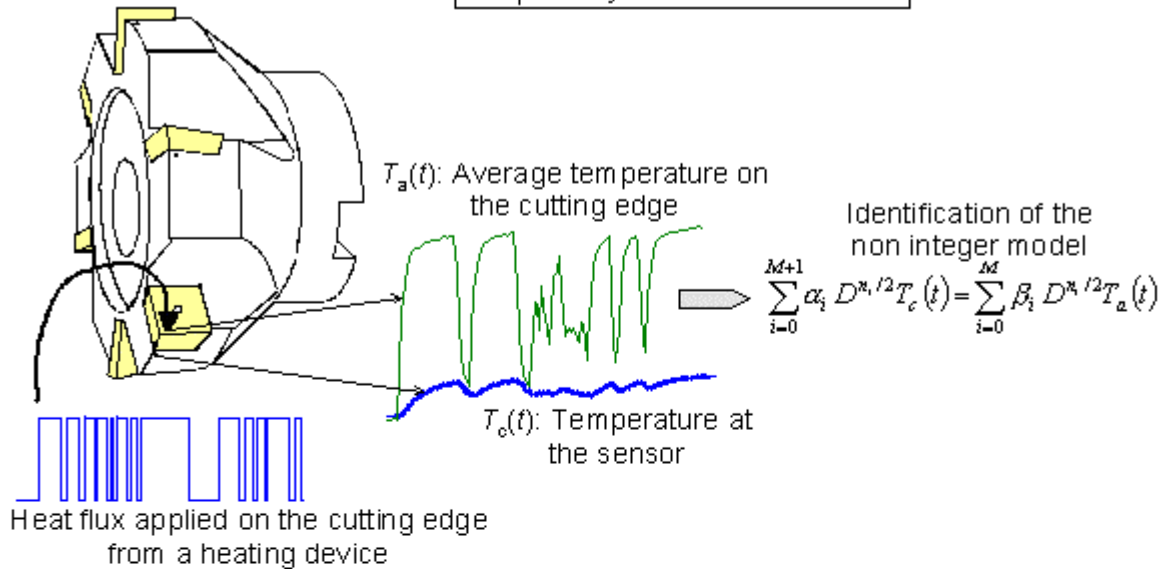
Mesure de température



Chaîne complète de mesure

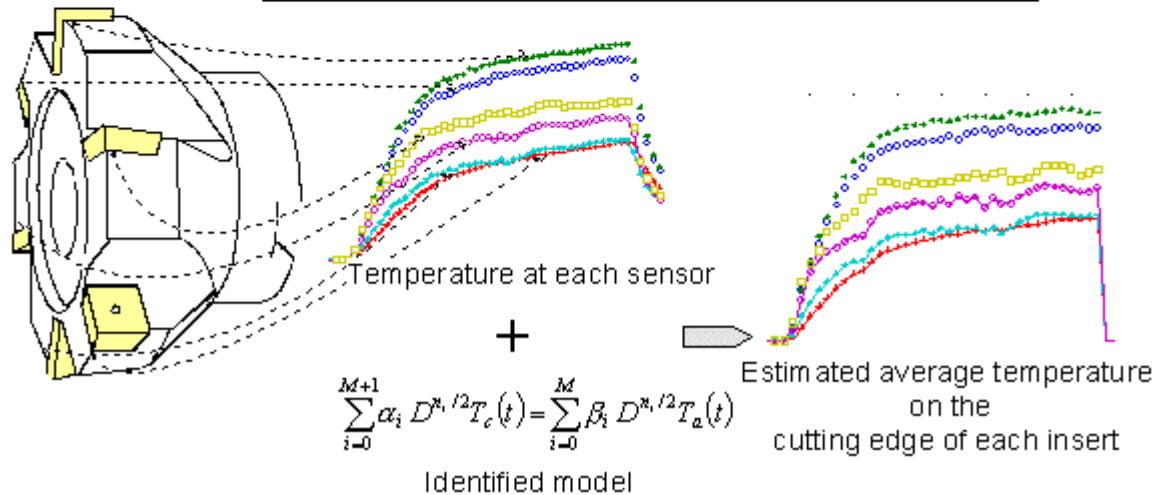


Step 1: System identification

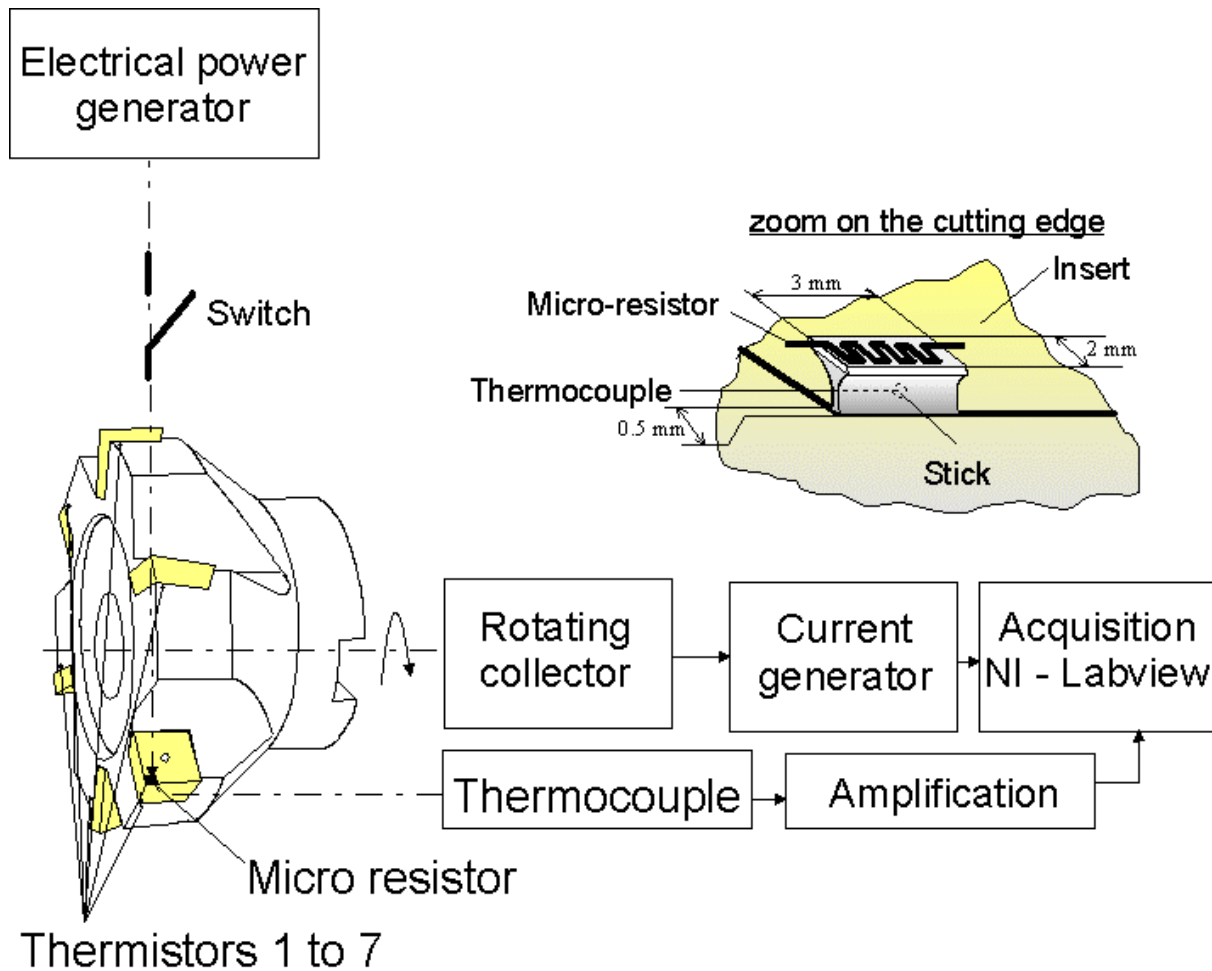


Démarche

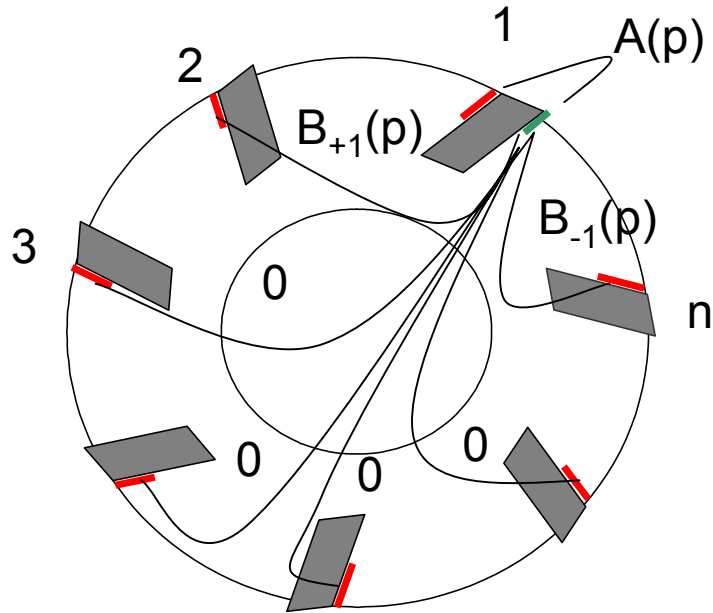
Step 2: estimation of the average temperature on the cutting edge during machining



Expérience de caractérisation de l'outil au sens de l'identification de système non entier



Expression du modèle de transfert



→ Considérations liées à la géométrie du système

$$\begin{bmatrix} \bar{T}_1(p) \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \bar{T}_n(p) \end{bmatrix} = \begin{bmatrix} A(p) & B_{+1}(p) & & & & & \\ B_{-1}(p) & & \cdot & & & & \\ & & & \cdot & & & \\ & & & & \cdot & & \\ & & & & & \cdot & \\ & & & & & & \cdot \\ B_{+1}(p) & & & & & & \end{bmatrix} \begin{bmatrix} \bar{\phi}_1(p) \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \bar{\phi}_n(p) \end{bmatrix}$$

Pour la plaquette i

$$\sum_{j=M_0}^M \alpha_{-1i} D^{j/2} T_i(t) = \sum_{j=L_0}^L \beta_{-1j} D^{j/2} \phi_{i-1}(t)$$

$$\sum_{j=M_0}^M \alpha_{0j} D^{j/2} T_i(t) = \sum_{j=L_0}^L \beta_{0j} D^{j/2} \phi_i(t)$$

$$\sum_{j=M_0}^M \alpha_{+1j} D^{j/2} T_i(t) = \sum_{j=L_0}^L \beta_{+1j} D^{j/2} \phi_{i+1}(t)$$

On somme ces trois relations



$$\sum_{j=M_0}^M (\alpha_{-1i} + \alpha_{0j} + \alpha_{+1j}) D^{j/2} T_i(t) = \sum_{j=L_0}^L \beta_{-1j} D^{j/2} \phi_{i-1}(t) + \beta_{0j} D^{j/2} \phi_i(t) + \beta_{+1j} D^{j/2} \phi_{i+1}(t)$$

En généralisant aux n plaquettes

On obtient un système linéaire à n équations

$$\begin{aligned} \sum_{j=M_0}^M a_j D^{j/2} T_1(t) &= \sum_{j=L_0}^L \beta_{-1j} D^{j/2} \phi_n(t) + \beta_{0j} D^{j/2} \phi_1(t) + \beta_{+1j} D^{j/2} \phi_2(t) \\ &\cdot \\ &\cdot \\ \sum_{j=M_0}^M a_j D^{j/2} T_n(t) &= \sum_{j=L_0}^L \beta_{-1j} D^{j/2} \phi_{n-1}(t) + \beta_{0j} D^{j/2} \phi_n(t) + \beta_{+1j} D^{j/2} \phi_1(t) \end{aligned}$$

Avec $a_j = \alpha_{-1j} + \alpha_{0j} + \alpha_{+1j}$

Soit

$$\mathbf{G}(t) = \mathbf{x}(t) \mathbf{q} + \mathbf{E}(t)$$

On considère les r données d'échantillonnages

$$\underbrace{\begin{bmatrix} \mathbf{G}(t) \\ \mathbf{G}(t + \Delta t) \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{G}(t + (r-1)\Delta t) \end{bmatrix}}_{\mathbf{N}} = \underbrace{\begin{bmatrix} \mathbf{x}(t) \\ \mathbf{x}(t + \Delta t) \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{x}(t + (r-1)\Delta t) \end{bmatrix}}_{\mathbf{X}} \mathbf{q} + \underbrace{\begin{bmatrix} \mathbf{E}(t) \\ \mathbf{E}(t + \Delta t) \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{E}(t + (r-1)\Delta t) \end{bmatrix}}_{\mathbf{E}_r}$$

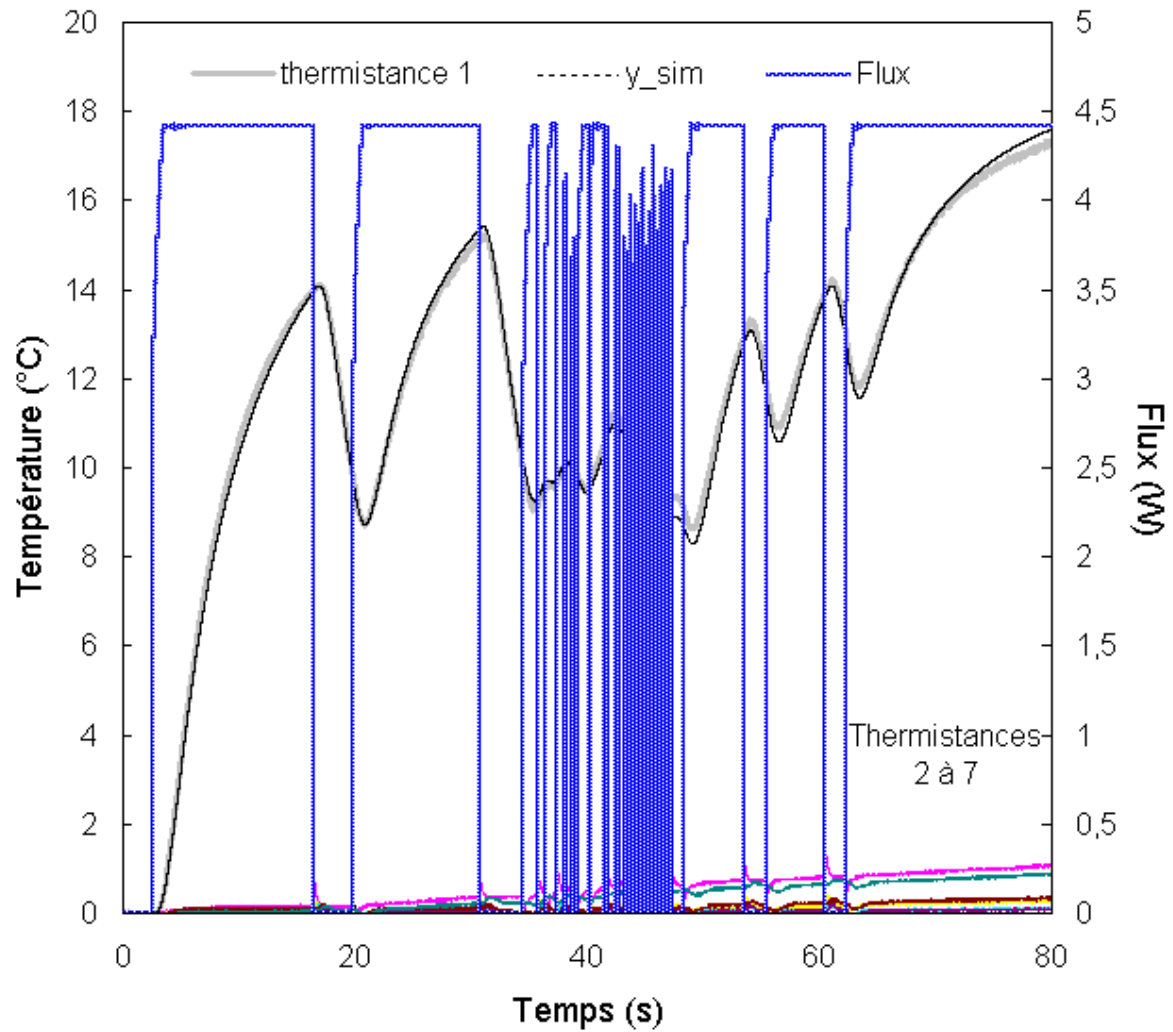
On cherche \mathbf{q} solution du système surdéterminé :

$$\mathbf{N} = \mathbf{X}\mathbf{q} + \mathbf{E}_r$$

Dont la solution aux sens des moindres carrés linéaires est :

$$\hat{\mathbf{q}} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T \mathbf{N}$$

Expérience de caractérisation



Estimation des flux au cours du procédé

