$$\frac{\partial f_{i,j}(\vec{x},\vec{c})}{\partial x_i} = \sum_{k \neq i} c_{k,j}$$

R&D

STEEL

The right formula
for the steels of the future

FIRST technical solution benchmark in
partnership with Ecole des Mines d'Ales

10/12/2019

First Project
Step 1

- Read CSV

- Store CSV data in database

- Compute Orowan model every 200ms with last available value

- Compute average of last 5 orowan friction coefficient every 1s and store them into database

- HMI
  - For every one
    - Login / logout
  - For the worker
    - Stand ID
    - Compute time of orowan
    - Friction coefficient factor
  - For the process engineer
    - Add / remove / update user
    - Add / remove / update user rights
    - Change application settings
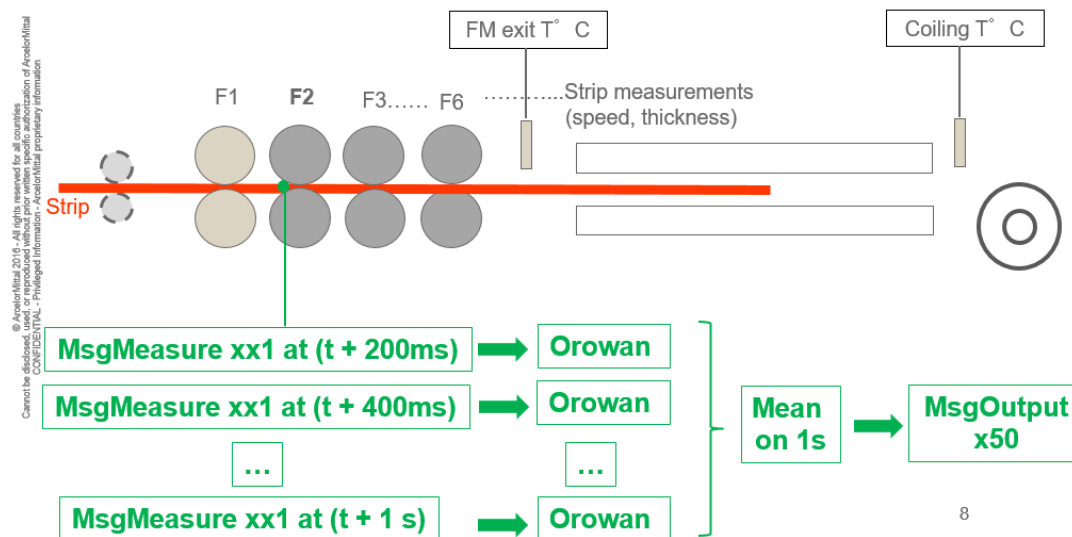   - Enable / disable stand
      - Change level 2 inputs range

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Step 2
Improve Orowan

owan com **FLAC Process events**

Exemple of calculation time: focus on F2

| FM exit T° C | | Coiling T° C |

F1   **F2**   F3…… F6

……..Strip measurements
(speed, thickness)

Strip

MsgMeasure xx1 at (t + 200ms) → **Orowan**

MsgMeasure xx1 at (t + 400ms) → **Orowan**

…   **…**

MsgMeasure xx1 at (t + 1 s) → **Orowan**

Mean on 1s → **MsgOutput x50**

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Step 3HMI

- Add curves for the operator
  - Friction
  - Roll speed
  - Sigma

- Create a password protection for the users

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Step 4
GRPC

- Use the LII simulator based on gRpc

- Use the orowan model based on gRpc

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Step 5
Time Series Database

- Store Level II data into a Time Series Database

- Store Orowan results into a Time Series Database

- Show data from the Time Series Database into the HMI

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