A sensor data-based approach for the definition of conditions taxonomies for a hydraulic pump

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INTRODUCTION - CAVITATION
EXPERIMENTAL BENCH

1. Closed-loop circuit
2. Sensors
   1. Pressure
   2. Flow
   3. Vibration
   4. Temperature
   5. Consumption
3. Valves
4. Experiment
DATA INGESTION

• Experimental bench and sensors
• PLC
• IoT Gateway
  • Node Red
• Cloud

EXPERIMENTAL BENCH \(\rightarrow\) PLC \(\rightarrow\) GATEWAY \(\uparrow\) NODE-RED \(\downarrow\) CLOUD, COMPUTER, ...

CLOUD, COMPUTER, …
DATA INGESTION – NODE RED

- Communication with PLC
- Selection of registers
- Transform calculation
- Signals calibration
- Data formatter
- Data collector
MEASUREMENTS

Node-RED

Collect data

Current consumption

Outlet Pressure

Flow rate

Temperature

Acceleration

Collect data

Current consumption

Outlet Pressure

Flow rate

Temperature

Acceleration
MEASUREMENTS
MEASUREMENTS
EXPLORATORY DATA ANALYSIS

1. Validation of data
2. Blockage states
3. 12-dimensional data
4. PCA
RESULTS - TOTAL
RESULTS – SOFT BLOCKAGE
RESULTS - MEDIUM BLOCKAGE
RESULTS – HEAVY BLOCKAGE
CONCLUSIONS

• Dataset of different blockage states
• Data have been enough accurate to show results despite the use of
  • Cost-effective sensors
  • Open-source software (node-RED)
  • Slow sampling frequency
• Differences among blockage states have been identified with PCA
• Future research on a condition monitoring system.
  • Training of a supervised learning model for the detection of different blockage states.
Thank you for your attention!

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