



**e feu**

Efficient Energy Use

# VSD-based fan impeller contamination build-up detection: industrial case study

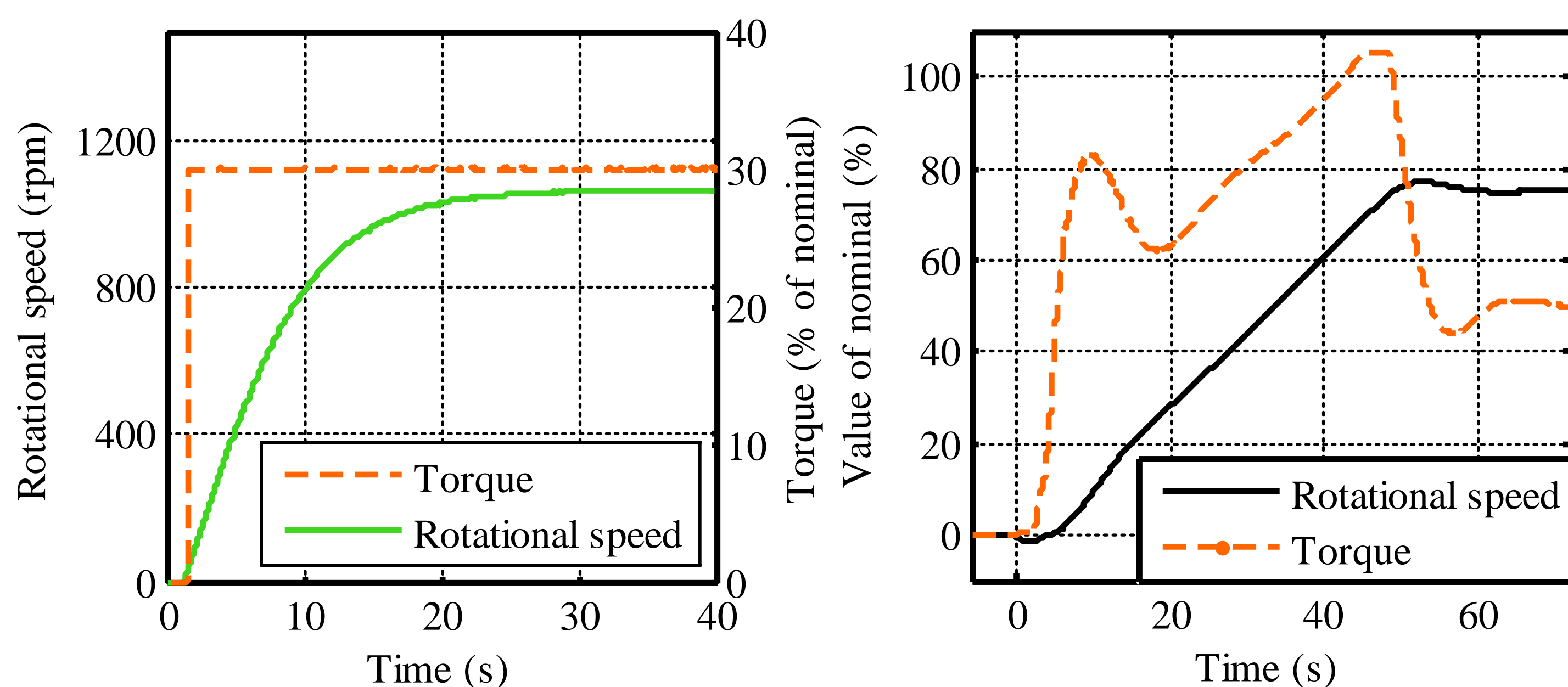
Contamination build-up can be considered as a root cause for the imbalance of the fan impeller, which may lead to fan failure. This can be detected without sensors by using a variable speed drive.

## Industrial fans

- Fans are used in various applications where contaminants are present and stick to the fan impeller.
- The contaminants can be considered as a root cause for imbalances in the fan, leading e.g. to a bearing failure.
- The contaminants increase the mass and thus the inertia of the fan, which can be used in the contamination detection.

## Contamination build-up detection

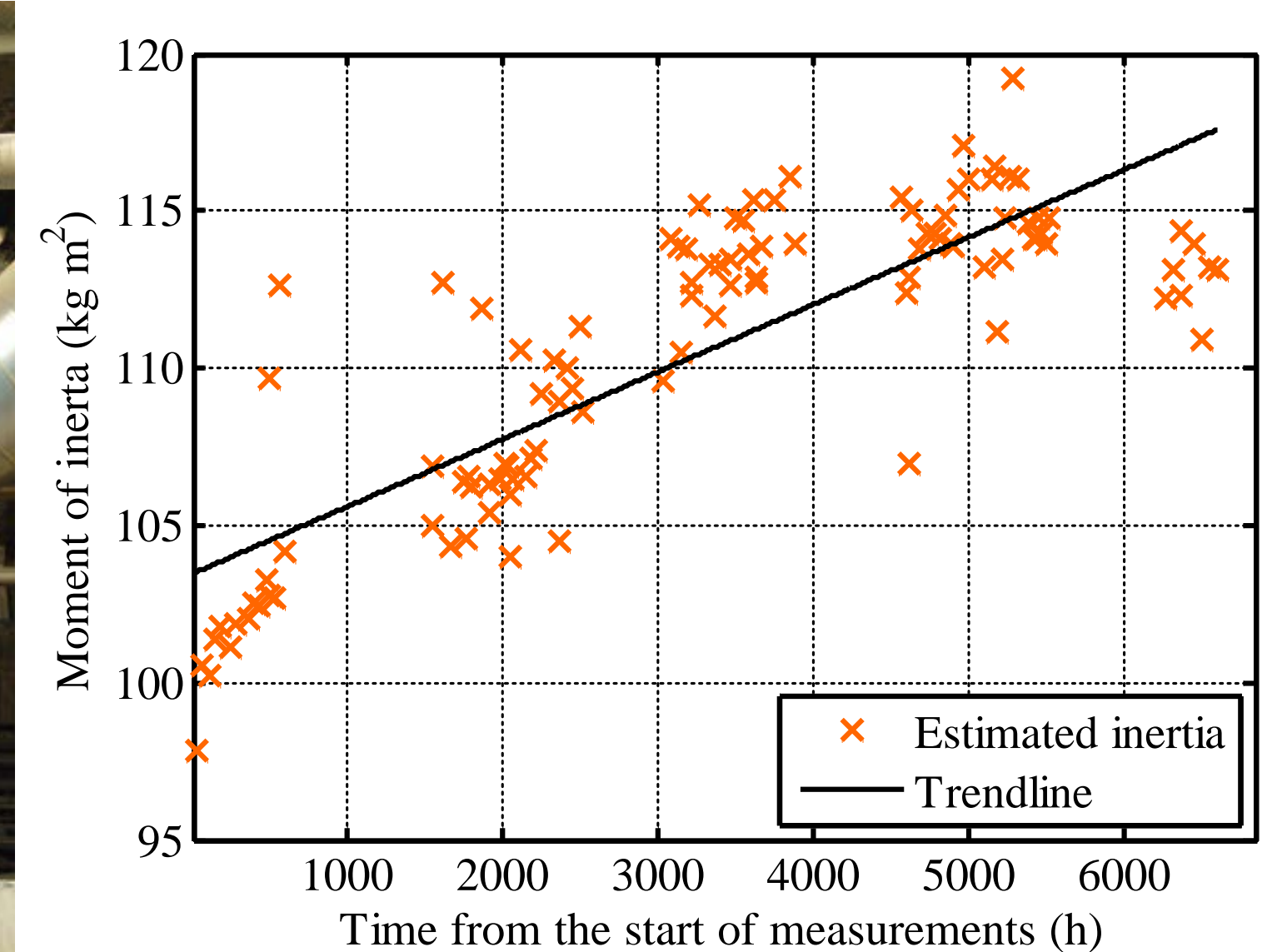
- Rotational speed control is de-facto in industrial fans. However, the contamination detection method has only been introduced for torque controlled fans.
- There is a significant difference in the fan start-up with constant torque and with typical rotational speed ramp:



- Build-up detection in rotational speed controlled fans can be done with *First Peak* and *Torque Integral* methods, which are based on monitoring the fan torque usage at certain rotational speed regions.

## Industrial case study

- Industrial fan in cement factory is responsible for transferring gases from cement kiln to heat up the coal furnace. The fan has a 1.4 m impeller, and it is started several times in a day.
- Fan is driven with a 75 kW induction motor and VSD. Fan system operation was monitored with the VSD for 7 000 hours with 10 ms sampling interval.
- After 5 500 h, a cleaning operation was performed and 5 kg of contaminants were removed, which corresponds to 2.5 kg·m<sup>2</sup> decrease in the fan inertia.
- This was successfully detected with the *First Peak* method, showing both the gradual mass increase and the effect of cleaning operation.



## Research findings

- Fan contamination build-up and need for maintenance can be detected with a variable speed drive.
- No changes to the fan system were needed, proving cost-effectiveness of VSD-based monitoring approach.

