

Total Process Control (TPC)

Degree programme: Master of Science in Engineering | Specialisation: Industrial Technologies

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External project partner: Frewitt SA, Granges-Paccot

The entire industrial sector has entered a phase of profound change that sees digital technologies integrate into the heart of industrial processes. This fourth industrial revolution gives birth to a new generation of plants that we call «Cyber-factory», «Integrated Industry», «Innovative Factory» or «Industry 4.0», this major technological break offers an extraordinary field of innovations, progress and growth.

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Introduction

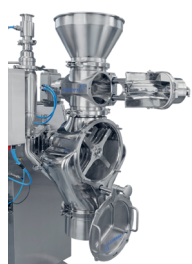
Since 1946, Frewitt Ltd., located near Fribourg, Switzerland, has been at the forefront in the development of milling processes, as well as the manufacturing of premium quality mills for renowned, industry-leading clientele active in the pharmaceutical, fine chemical, and food sectors.

Most industrial machines processing, handling or processing matter wear and degrade over the time. In most of the cases, a tool or a machine is substituted when it is broken. But today, thanks to new technologies, more and more so-called intelligent machines are emerging. These machines are for example able to know exactly when a tool must be changed, to stop a process autonomously if a defect is detected, or to recognize if the used tools are well suited.

Project description

With increasingly innovative technologies and increasingly intelligent machines, the machines must be as autonomous and efficient as possible. Therefore «Total Process Control (TPC)» project was set up to equip Frewitt's machines with several sensors: avoid errors, detect/predict failures, avoid counterfeiting and guarantee the availability and productivity of the equipment and a maximum level of product quality. This project can be summarized in three main objectives:

- 1. Online flowrate measurement:** indeed, by measuring the output powder flowrate, it would then be possible to detect any anomaly in the process (clogging, tools broken).



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- 2. Tools detection:** with a certain technology such as RFID, we could check whether the tool corresponds to the right manufacturing process selected but also and especially to avoid counterfeits.
- 3. Foreign body and contact rotor-sieve detection:** this latter area is very important because it can avoid major mechanical breakages, product pollution and also explosions.

Results and conclusion

The results of the project are explained in the three following main objectives:

1. Online flowrate measurement:

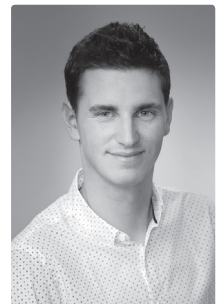
- Only the sensor using microwaves (FlowJam S) was usable.
- This sensor is able to measure flowrates up to 1 tons/hour (flour).
- Depending on the flowrate and the pipe diameter, an inside process problem (clogging, drilling, etc...) can be detected.

2. Tools detection:

- Selection, test and encapsulation of a commercial RFID Tag. It has been demonstrated that it is still able to detect through 2 mm of stainless steel, which fulfill the target specifications.
- New prototype (RFID sensors and tags) designed and tested.
- ATEX O/20 certification for the tag and the sensor has started.
- A cost estimate of sensor and tag implementations on the three machines mentioned above has also been carried out.
- It is now possible to detect tools and avoid forgeries.

3. Foreign body and contact rotor-sieve detection

- Metal foreign bodies with a size up to 2 mm (target 1.5 mm) diameter were detectable with a speed of 300-1800 rpm.
- Designed of a prototype in 3D to easily connect the sieve with the PLC which could be used in explosives zones.
- This technology not only allows the detection of foreign bodies, but also the detection of sieve-rotor contacts. This last point, however, was not tested in this study.



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