Smart Hammer Mill

A virtual engineer, fully dedicated to the state-of-health of your installation: **InfraLytics®**

The Context

Hammer mills are used in a variety of industries. The goal is to crush or break an incoming material flow or turn it into powder. Next to the mining industry, it's also encountered in animal nutrition, beer brewing, but also in pharmaceuticals or recycling plants. In this type of machine the concept of product quality and availability are related as well. Hammer mills are operated most often in a continuous mode. A smooth running results mostly in uniform and high product quality, where unforeseen standstill leads to reduced income for the site and excessive wear leads to increasing maintenance costs. How can one achieve high product quality and avoid unexpected stops of production runs?

Hammer Wear

The hammers are in continuous contact with the material, performing an abrasive operation. As a results the hammers do gradually wear down. Also specific products or configurations of the feed stream may result in accelerated wear. One of the difficulties is deciding when to replace the hammers: finding the balance between mill performance and the cost of a new hammer. Using a continuous follow-up based on vibrations in 3 directions and motor currents the software can track the degree of degradation and, including flow rates, determine the optimal point for hammer exchange. When this point has been reached, the operator is warned.

The Solution

At Zensor we provide a dedicated, modular, product for the continuous follow-up of hammer mills. The product comes in the form of a dedicated software and a hardware add-on if not enough data would be available. At first the client indicates which of the aspects (listed below) are relevant to their mill, and subsequently the Zensor specialist finalizes the product configuration. When required additional hardware is installed. Once launched, the software continuously crunches the incoming data and translates it into suggestions in case of quality issues and warnings in case of upcoming damage or breakdowns. As the product types or recipes treated by a hammer mill may vary with time, the software also takes these variations into account when setting boundary values or tracking correlations.

Bearing health

The bearings are continuously in use as well, continuously taking the unbalanced loads resulting from the often irregular material feed. Combining a follow-up based on vibrations and temperatures, the software tracks the state-of-health of the bearings continuously. Deviations are detected in an early stage based on thermal and spectral analysis and the maintenance crew is informed when necessary.

Motor health

The main motor is driving the heart of the operation of the mill. The motor is running continuously, not always fully shielded of the load variations coming from the dynamic process it is piloting. Combining a follow-up based on vibrations, temperatures and electrical currents the software tracks the state-of-health of the motor continuously. Deviations are detected in an early stage based on spectral analysis, motor faults are detected based on electrical signals. As a result unwanted standstills or major damages are prevented.

Operational stability

Ideally the milling process is super smooth. In reality however mechanical deformations can cause a non-even operation of the mill. The axle being too loose or bent, hammers being deformed, a seal that is not closing well... All these issues lead to either reduced operational efficiency or to an accelerated degradation of other components, hence increased maintenance costs and reduced availability. Using continuously acquired vibrational data the software can identify these issues and send out a warning when they appear, providing ample time to intervene before follow-up damage is incurred.

Gearbox health

The gearbox in a hammer mill is not necessarily very complex, but subjected as well to the variable loads originating from the milling process. In an optimal case, gearbox degradation is detected in an early stage, such that repairs or replacements can be planned and failure can be avoided. Using data about product type and RPM as well as temperatures, currents drawn by the main motor vibrations on multiple locations, the software performs a continuous follow-up. Using classical spectral analysis together with models trained on how the specific machine operates, deviations are detected in an early stage and operating conditions that lead to damage development are identified in an early stage.

Process optimization

The efficiency of the process is also governed by properties of the material feed and the environment. The humidity of the material going in, the ambient temperature, material temperature, air flows in and out... all play their role on how the process runs. When the software is supplied with the correct data streams it can assist in finding the optimal process parameters as a function of these external conditions.

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