Mill Charge Level Meter

Description

The Mill Charge Level Meter (MNC) is designed to improve the efficiency of SAG and ball mills by providing a real-time measurement of charge volume. The MNC measures the stresses affecting the bolts that secure the liners (Figure 1) to predict the charge level.

The MNC is an innovation in mining-process measurement and inference. Its streamlined, easy-to-install design (Figure 2) provides highly useful information to support the monitoring of critical processes within the SAG mill.

Solution benefits

The system supports the operation in the following areas:

1 - Prevent risks and improve personnel and equipment safety.

2 - Increase mill availability and service life.

3 - Increase MTBF.

4 - Reduce emergencies associated with unexpected failures.

5 - Reduce maintenance costs.

6 - Improve production quality.

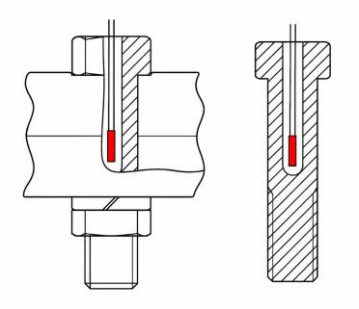


Figure 1: Sensor bolt with strain gauge

Operation

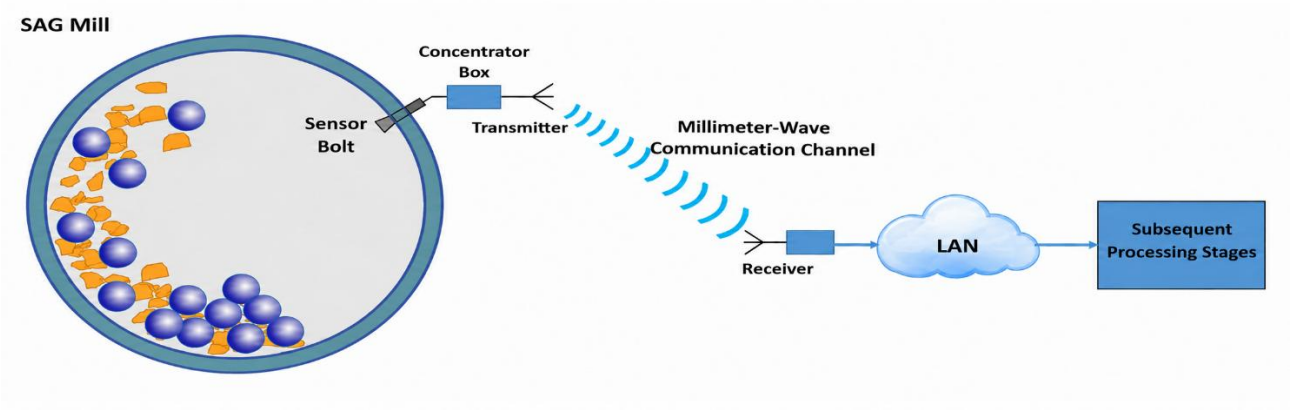


Figure 2: Installed MNC system

The MNC uses accelerometers, strain gauges, and a gyroscope (Figure 3) to determine, through expert inference, the applied stress and the bolt's angular position during each mill rotation.

The measurements produce a characteristic curve for each SAG mill rotation. This curve is used to calculate the charge level and, together with other measurements, support failure prediction in the mechanical joint formed by the shell, liner, and bolt (Figure 4).

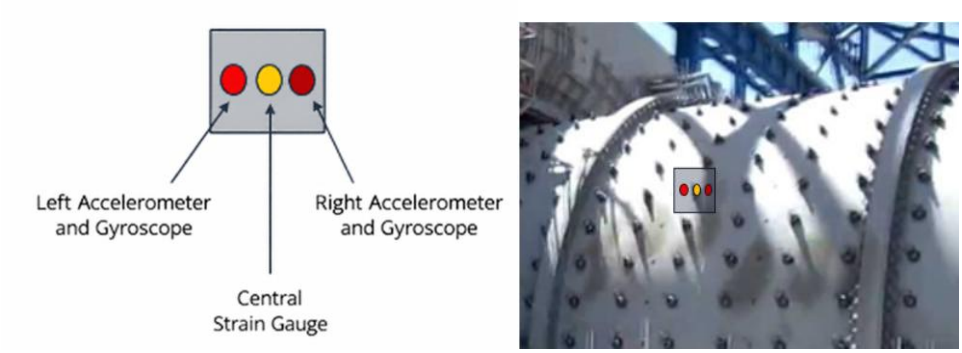


Figure 3: Sensor locations

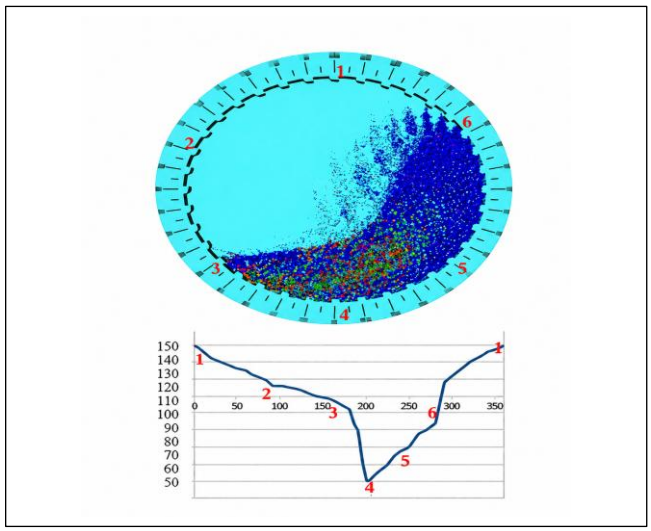


Figure 4: Charge curve

Results

The MNC generates a time series of values that enables the data specialist to improve the training and subsequent use of the system's intelligent failure-prediction algorithm. Combined with other variables already measured in the SAG mill, it supports early failure detection in the mechanical joint system comprising the shell, bolt, and liner.

The initial variables may include percentage of critical speed, bearing pressure, power consumption, feed flow, and, of course, fill level (Figure 5).

During the first month of operation, the relationships among these variables are reviewed. The system is then trained and deployed in production to predict the related conditions.

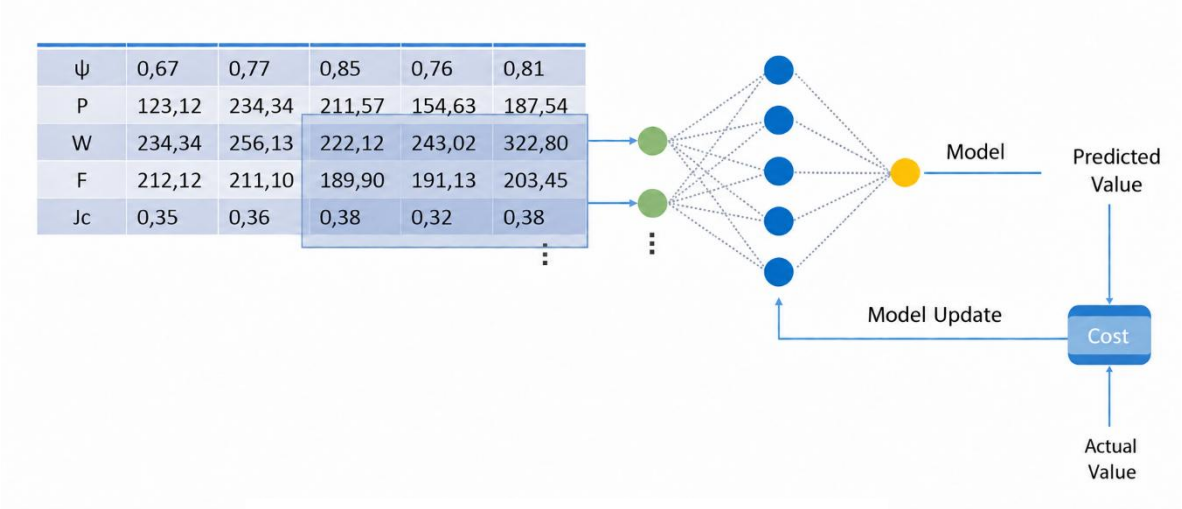


Figure 5: Measurement system

Decision support

The Mill Charge Level Meter supports the supervisor's decisions to:

1 - Prioritize systems for maintenance.
2 - Implement improvements to the maintenance plan.
3 - Predict failures.
4 - Increase MTBF.
5 - Improve equipment availability and reliability.

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