

Traveling Grate Level Control

The traveling grate is a twelve foot wide steel belt that carries iron ore, in the form of soft ½ inch diameter pellets, through a furnace. While on the traveling grate, hot air is blown through the bed to dry and preheat the pellets in preparation for being discharged into a rotary kiln. The pellets undergo an oxidation-reduction reaction in the kiln resulting in a change of chemistry and a hardened product suitable for transport to and use in blast furnaces.

The thickness of the bed in the traveling grate must remain consistent, despite fluctuations in the feed rate from upstream equipment, to maintain constant performance from the rotary kiln and maintain chemistry for the blast furnace. Erratic bed level sensing was causing unacceptable bed level fluctuations.

I worked with level sensor suppliers and selected a capacitance-based level sensor. The sensor consisted of a narrow steel plate that spanned the width of the grate. The probe was energized with high frequency AC. Bed level changes were seen as a change in capacitance and associated capacitive reactance. A transducer converted the reactance to a 4-20 mA signal. The sensor was installed and monitored to verify its reliability and repeatability.

I designed a control system using a digitally based controller that allowed me to program the following crucial functions. First, the controller linearized the signal from the capacitance probe to provide a linear signal proportional to bed level. Second a proportional-integral control loop was programmed into the controller to develop a signal to be sent to the grate's variable speed drive. Finally, the controller was programmed to interact with operator interfaces to provide the operator with process information and allow seamless transitions between manual and automatic control.

The completed system provided smooth operation of the traveling grate that was needed by plant operations.