Control Model for Tandem Hot Metal Strip Rolling

In the manufacturing and processing of metals, especially steel, tandem metal strip rolling is a critical process. Almost half of all finished steel products worldwide start in sheet or strip form produced using hot strip rolling processing—very often in a tandem hot strip finishing mill. Challenged by a hostile high-temperature environment and no space for sensors, the strip rolling process requires measurements of variables such as strip speed and intermediate stand thickness. Previous control strategies have often fallen short when complicated tuning methods were more advanced than the working knowledge of personnel, who are likely to have a limited background in advanced control techniques. Even when personnel are highly trained, conventional approaches to metal strip rolling have been unnecessarily time consuming, requiring multi-step calibration of subprocesses before and during production.

UCF researchers have developed an advanced control model for the highly complex nonlinear system of tandem hot metal strip rolling. The new method outperforms conventional strategies by addressing the dynamic interactions among variables, reducing complexity for easier computing—translating to less scan, design, and commission time—with minimized excursions and deviations. Because the need for multi-step calibration is reduced, mills are up and running faster and a better product is manufactured while incurring less cost.

Technical Details

The comprehensive process model works as a set of mathematical expressions relating rolling process parameters to each other. The method works by first predicting deformation to the work piece, inherent in the roll bite and its dynamics as it moves through the mill, then modeling the looper mechanism dynamics including the effects on strip tension, and finally estimating the temperature of the work piece at each mill stand.

Benefits

• Comprehensive
• Accounts for interdependent variables
• Reduces scan time
• Minimized tuning
• Wider skill level usability

Applications

• Metal manufacturing and processing

Technology #32121

• US Patent 9,095,886 B2

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