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Optimal Control of a Continuous Tandem Cold Metal Rolling Process Using a State- Dependent Riccati Equation Technique

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Abstract

This work is concerned with applying optimal control techniques for improving the exit thicknesses and interstand tensions in a continuous metal cold rolling process. Recent work done at the University of Pittsburgh as part of a PhD dissertation has shown that the application of a state-dependent Riccati equation technique was quite successful in improving the tolerances in stand exit thicknesses and interstand tensions in a discontinuous process. This basically means that the rolling mill was stopped and rethreaded for each coil change. However, recent technology in cold rolling has provided for the capability of continuous rolling from coil to coil. The work proposed herein is an extension of our earlier work to apply to a configuration wherein the mill is coupled to a pickling process through a strip storage device to allow continuous mill operation, with coils being welded together at the entry of the pickling process. In continuous mill operation the strip characteristics change "on the fly" during passage of the weld which requires maintaining the tolerances in the strip thicknesses and interstand tensions within acceptable limits during this period of transition. In this project, our earlier results in model and control configuration developed for discontinuous operation will be extended as needed for continuous operation.

Simulations will be performed to verify the updated model and confirm performance and robustness to typical disturbances and uncertainties in modeling and measurement during steady speed and during speed changes for weld passage. The results will be compared to data from actual applications and presented in a final report.