Memo

25 March 2019

Subject: Internship assignment (systems and control engineering)

Training period: 3-6 months in 2019
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Project Title: Predictive control for air cooling in steel galvanising

Tata Steel are one of the leading producers of steel worldwide. One of the main products made by their IJmuiden facility is galvanised steel strip of typically 0.3 to 3 mm thick. These strips are cast as bars, then hot and cold rolled and finally annealed before being coated with zinc by hot dipping (i.e. running the strip through a bath of molten zinc). After exiting the zinc bath, the strips are cooled using air knives.

Tata Steel’s R&D department have developed a dedicated control program for the hot dip galvanising lines, based on first principle process models and a model predictive control strategy. The program calculated target settings for the various heating and cooling sections of the production line, as well as the line speed, to ensure the strip is at a suitable temperature in every phase of the galvanising process.

One of the main challenges in this development is that few strip temperature measurements are available and that both measurements and models are subject to errors. To account for this, adaptation routines are included in the program.

For the air knife control, the current version the adaptation routine requires a constant speed to find the steady state error. This is a consequence of the distance between air knives and the temperature sensor, which translates to a pure time delay. In practice, the line speed varies and therefore a correction for the time delay in the control loop would constitute an important improvement to the control program.