

REVIEW ON MASTER'S THESIS

Name: Yuksel Can Kutlu

Thesis title: Parameter identification and filter design for a repetitive controller of hot rolling mills

The aforementioned master's thesis presents procedure for system parameter identification and filter design for a repetitive controller applied to strip thickness control in hot strip mill. The thesis starts with the state of the art in the fields of system identification, stability analysis and internal model control (IMC). Particularly the repetitive control is highlighted as the special case of the IMC. Next the assigned objectives of the thesis are gradually solved. Starting from the strip thickness model identification applying ARMAX model derivation two types of filter for the IMC are designed for roll eccentricity compensation. The first type designed is the second-order filter with damping factor less than 0.7 and this filter is applied within the IMC to cancelling the roll eccentricity medelled by harmonic disturbance. To improve the periodic disturbance cancellation via the repetitive control the third-order filter is designed, composed of the previous second-order filter and the first-order filter. Both types of filters are tested on their damping factor impact on the gain and phase margin. Since with decreasing the damping these margins deteriorate the third-order filter is applied rather than the second-order filter. This filter provides better variability in its design and also robustness against the thickness model variation because the low damping factor is compensated by enough long filter time constant. Finally this filter is applied to the repetitive control design and validated on strip thickness control wich is loaded by the roll eccentricity generating the periodic disturbance.

In the thesis significant results for tuning the IMC filter are obtained by means of the comparative study which shows that the filter has to be at least of the third-order to achieve satisfactory robustness of the repetitive control. The master's thesis is very well written with very good English. The following questions have arisen to be answered

- What is an optimum order of the IMC filter with respect to the robustness?
- What is the robustness of designed filters against the variability of disturbance periodicity? Or what filter would be necessary to design for meeting this robustness?

With respect to aforementioned facts and achievements, Yuksel Can Kutlu completely met his master's thesis assignment and therefore I fully recommend his master's thesis for the defence with a grade

= excellent=

Prague, 24.6.2019

Ing. Jaromír Fišer, Ph.D.
reviewer