Computer Exercise 4  
EL2520 Control Theory and Practice

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# Minimum phase case

## Dynamic decoupling

The dynamic decoupling in exercise 3.2.1 is



Figure : Bode diagram of G(s) derived in exercise 3.2.1

  


Figure 2: Simulink plots from exercise 3.2.4

Is the controller good?

*Well, it is almost decoupled (since one output only has a small deviation from their reference when the other changes, refer to Figure 2), but the overshoot is at almost 10%, which is a bit high. It can be regarded though as reasonably well-tuned.*

Are the output signals coupled?

*Almost, since a change on one of them does affect the other but very little, as we can see on the simulation in Figure 2.*

## Glover-MacFarlane robust loop-shaping

  


Figure : Simulink plots from exercise 3.3.4

What are the similarities and differences compared to the nominal design?

*The new controller is robustified compared to the initial decentralized controller. Comparing the graphs in Figures 2 & 3, we can see that the rise time &* settling *time are almost similar, but the overshoot now is much lower <5% than in the nominal case.*

# Non-minimum phase case

## Dynamic decoupling

The dynamic decoupling in exercise 3.2.1 is



Figure : Bode diagram of G(s) derived in exercise 3.2.1

  


Figure : Simulink plots from exercise 3.2.4

Is the controller good?

*The controller is very slow (almost 150 seconds to settle to its final reference value, refer to Figure 5). The overshoot though is very small (almost 5%), which is better than the minimum phase decoupled controller in Figure 2.*

Are the output signals coupled?

*No, they are not. Figure 5 shows clearly that the system is decoupled. A change in one of the outputs does not affect the other at all.*

## Glover-MacFarlane robust loop-shaping

  


Figure : Simulink plots from exercise 3.3.4

What are the similarities and differences compared to the nominal design?

*Comparing Figures 5 & 6, we see that the controller is very slow in both cases (around 150 seconds to reach its settling reference value), but compared to the nominal design, the overshoot is 0% on the Glover-McFarlane case. A robustified controller.*