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

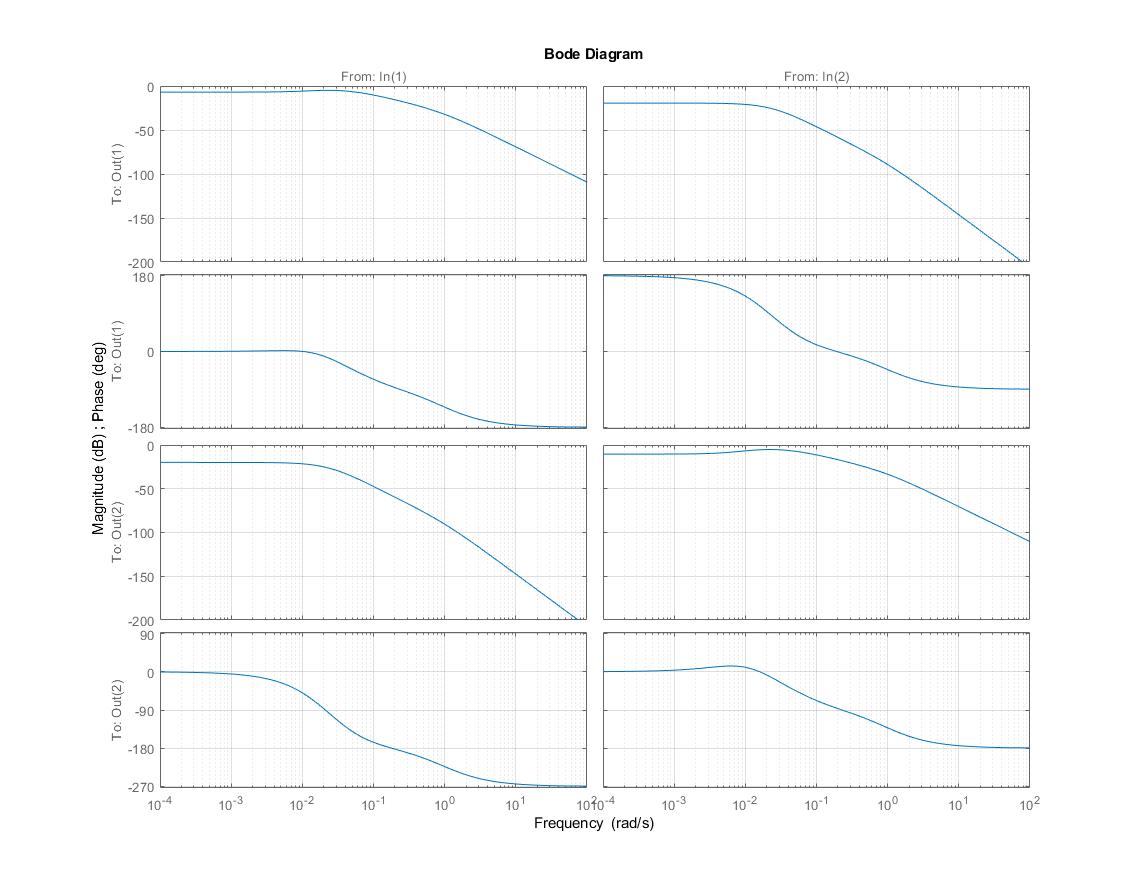


Figure : Bode diagram of G(s) derived in exercise 3.2.1

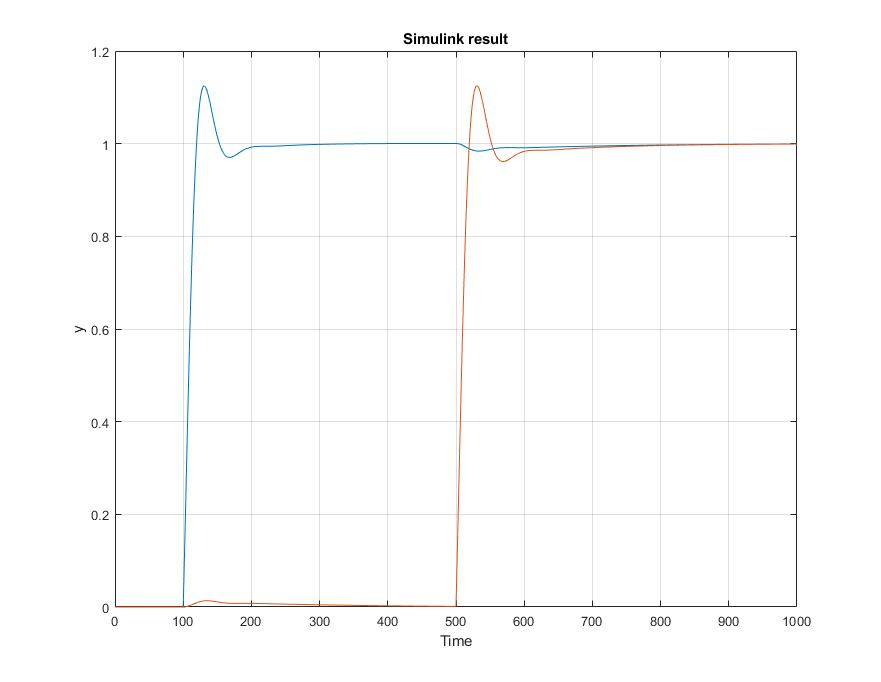


Figure : Simulink plots from exercise 3.2.4

With this controller, the input to paired with output and is paired with . The Simulink plot shows that the decoupling works well since a step in one output affect the other output by less than . This shows that the two outputs signals are very weakly coupled. Both of the outputs converge to the reference which is and the oscillation is minimum. Thus, this controller works well in this situation.

## Glover-MacFarlane robust loop-shaping

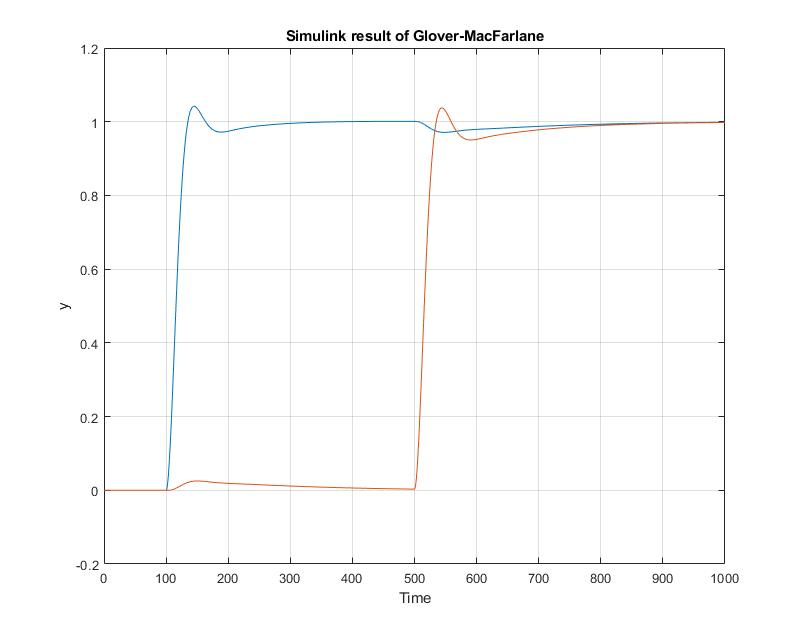


Figure : Simulink plots from exercise 3.3.4

From the plot above we see that the controller gives a slower system however it decreases the overshoot to increase the robustness. Both of these controllers successfully decoupled the system.

# Non-minimum phase case

## Dynamic decoupling

The dynamic decoupling in exercise 3.2.1 is

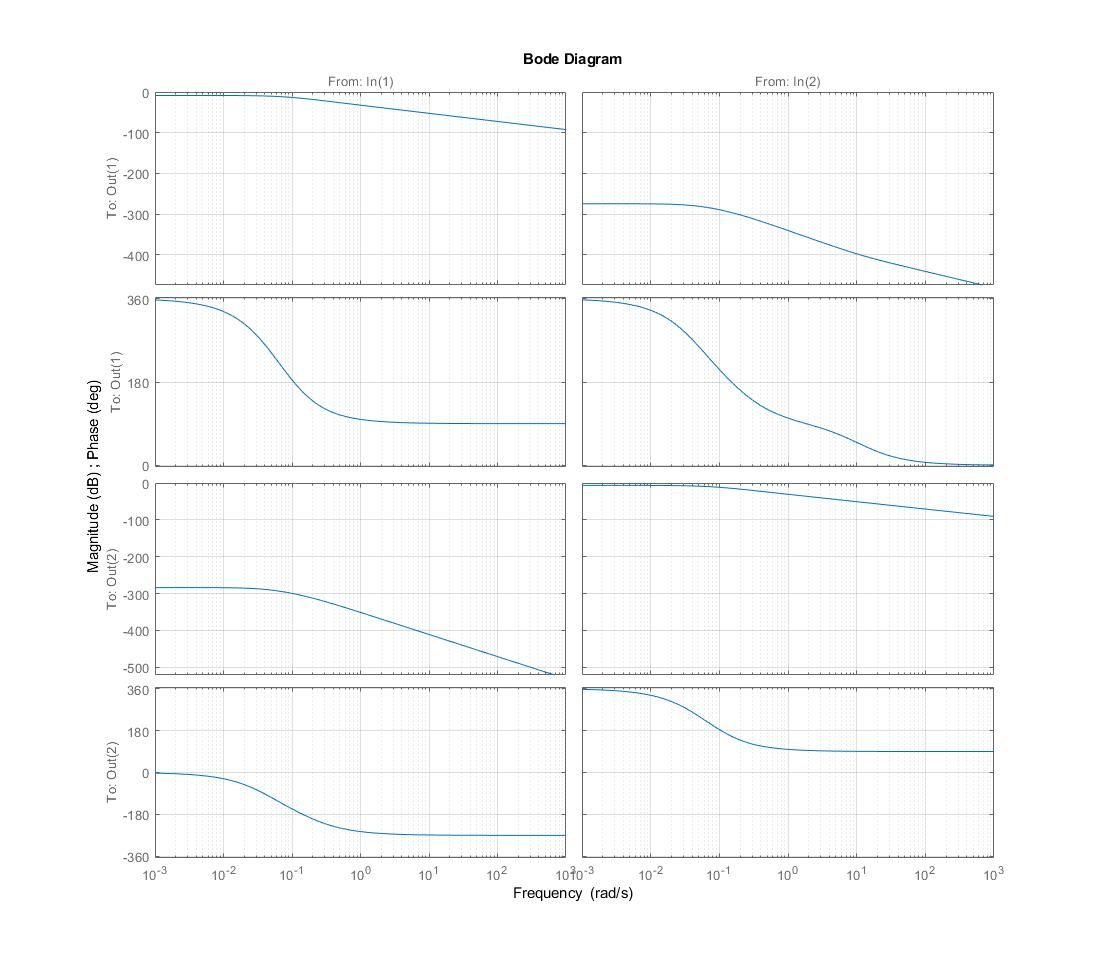


Figure : Bode diagram of G(s) derived in exercise 3.2.1

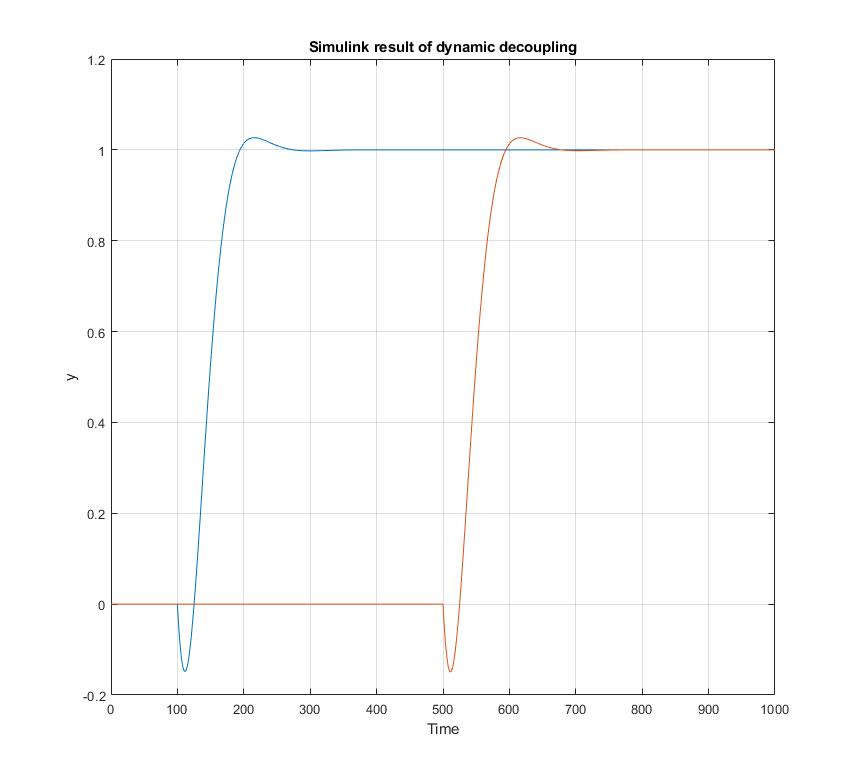


Figure : Simulink plots from exercise 3.2.4

The controller decouples the system greatly since any output does not influence the other one at all. The system is completely decoupled.

## Glover-MacFarlane robust loop-shaping

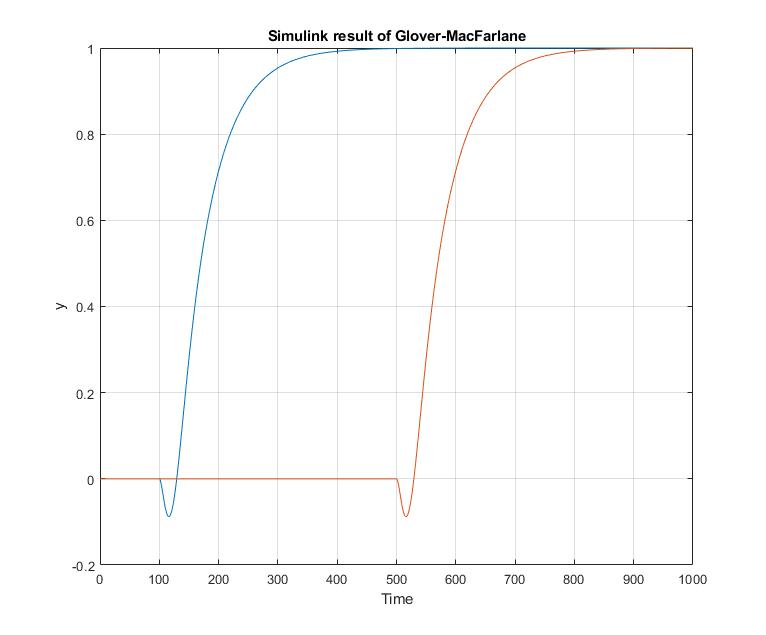


Figure : Simulink plots from exercise 3.3.4

In the non-minimum phase case, the system become much slower like the minimum phase system. However the overshoot completely disappeared now.