

Advanced Topics in Control 2014: Robust Control and Convex Optimization

Exercise 9: Project system definition

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May 1, 2014

Please submit your solutions as a **single PDF** with filename *ATICXX-Surname-StudentNumber.pdf* (XX is the exercise number) to *ifaatic@ee.ethz.ch* until May 9th, 09.59 (next Friday). The subject of the email should be *[ATICXX] Surname-StudentNumber*.

This straightforward task gets the ball rolling with the ATIC project. Material from this exercise may (but doesn't have to) appear in your final report.

- a) Give a linear time-invariant representation of the model you are using for the project:
 - i) Explain any linearizations or approximations that have been necessary to get to an LTI system.
 - ii) Draw a block diagram of the system including uncertainties.
 - iii) Convert this to standard $M\Delta$ form, giving the structure $\mathbf{\Delta}$ of uncertainty Δ .
 - iv) List the physical meanings of the inputs, states and outputs.
 - v) State the sources of uncertainty and their potential sizes.
- b) Plot nominal step responses of the system (how many you plot depends on the dimensions of your system). If the system is open-loop unstable, truncate the plot in a sensible way.
- c) Now plot some representative responses that could come about for different values of the uncertainty $\Delta \in \mathbf{\Delta}$, with $\|\Delta\| \leq 1$. Comment briefly on the differences between these and the nominal responses.