



## COURSE OUTLINE

Chapters 1, 2	Introduction, definitions of multivariable and robust control, form of the standard control problem, performance characteristics and limitations – 1.5 class periods.
Chapter 3	Multivariable systems, the importance of eigenvectors, getting performance improvement through eigenstructure assignment, singular values, defining the poles and zeros of a multivariable system – 1.5 class periods.
Chapter 4	Controllability and observability, internal stability, parametrization of all stabilizing controllers, stability analysis, operator norms – 2 class periods.
Chapter 5	Performance limitations in SISO systems, constraints on the sensitivity and complementary sensitivity transfer functions, limitations on performance caused by right-half plane poles and zeros and time delays – 2 class periods.
Chapter 6	Performance limitations in MIMO systems, constraints on the sensitivity and complementary sensitivity transfer functions, limitations on performance caused by right-half plane poles and zeros and time delays – 1 class period.
Chapter 7	Models for system uncertainty, uncertainty in the frequency domain, stability robustness, performance robustness – 2 class period.
Chapter 8	Robust stability and performance for MIMO systems, robust stability with structured and unstructured uncertainty – 1 class period.
Chapter 9	The Linear Quadratic Gaussian (LQG) problem, robustness of the linear regulator and of the Kalman filter, loss of robustness with the LQG structure, maintaining robustness through loop transfer recovery (LTR), formulating the $H_\infty$ problem, the model matching problem, and a numerical robust control design algorithm – 4 class periods.

## References

- [1] B. Barmish, *New Tools for Robustness in Linear Systems*. New York: Macmillan, 1994.
- [2] S. Bhattacharyya and L. Keel, *Control of Uncertain Dynamic Systems*. Boca Raton, FL: CRC Press, 1991.
- [3] S. Bhattacharyya, H. Chapellat, and L. Keel, *Robust Control, The Parametric Approach*. Upper Saddle River, NJ: Prentice Hall, 1995.
- [4] J. Doyle, B. Francis, and A. Tannenbaum, *Feedback Control Theory*. New York: Macmillan, 1992.
- [5] B. Francis, *A Course in H Infinity Control Theory*, vol. 88, Lecture Notes in Control and Information Sciences. Berlin: Springer-Verlag, 1987.
- [6] M. Green and D. Limebeer, *Linear Robust Control*. Englewood Cliffs, NJ: Prentice Hall, 1995.
- [7] M. Grimble, *Robust Industrial Control*. New York: Prentice Hall, 1994.
- [8] J. Maciejowski, *Multivariable Feedback Design*. Reading, MA: Addison-Wesley, 1989.
- [9] M. Vidyasagar, *Control System Synthesis*. Cambridge, MA: MIT Press, 1985.
- [10] K. Zhou, *Essentials of Robust Control*. Upper Saddle River, NJ: Prentice Hall, 1998.