Theoretical Questions for the Final Exam in 332: 510 — Spring 2000

Friday, May 5th, 7–10pm, or Monday May 8th, 7–10pm; ELE 202 Lab

1. Define and solve the linear-quadratic continuous-time optimal control problem with hard constraints using the transition matrix approach (Bryson, p. 243–245; Class note (8), p. 7–8).
2. Define and solve the linear-quadratic continuous-time optimal control problem with hard constraints using the Riccati equation approach (Bryson, p. 246–247; Class note (8), p. 9–11).
3. Define and solve the linear-quadratic discrete-time optimal control problem with hard constraints using the transition matrix approach (Bryson, p. 251–252; Class note (8), p. 14–15).
4. Formulate and solve the general continuous-time linear two point boundary value problem (Bryson, p. 250–251; Class notes (8), p. 12–13).
5. Define and solve the linear-quadratic continuous-time regulator problem and derive the corresponding algebraic Riccati equation (Bryson, p. 261–262; Class notes (10), p. 1).
6. Show that the continuous-time Hamiltonian matrix has eigenvalues that are symmetric with respect to the imaginary axis (Bryson, p. 263; Class notes (10), p. 2).
7. Present the eigenvector method for solving the algebraic Riccati equation (Bryson, p. 263–264; Class notes (10), p. 3).
8. Define and solve the linear-quadratic discrete-time regulator problem and derive the corresponding algebraic Riccati equation (Bryson, p. 281; Class notes (10), p. 4–5).
9. Derive the expression for the optimal value of the performance criterion for the linear-quadratic continuous-time regulator problem (Class notes (10), p. 7–8).
10. Present the linearization techniques of nonlinear system about nominal trajectories and controls (Class notes (11), handout on linearization).
11. State Bellman's principle of optimality (Class notes (12), p. 1–2).
12. Derive the recursive relation of dynamic programming for a nonlinear dynamic system and a general performance criterion (Class notes (12), p. 4–6)
13. Solve the linear-quadratic discrete-time optimal control problem using dynamic programming (Class notes (12), p. 8–9).
14. Derive the Hamilton-Jacobi-Bellman equation (Class notes (12), p. 12); Bryson, p. 298).
15. Using the Hamilton-Bellman-Jacobi equation solve the linear-quadratic continuous-time optimal control problem (Class notes (12), p. 12–13).
16. Derive necessary conditions for optimality subject to control inequality constraints (Pontryagin's minimum principle), (Class note (12)-second part, p. 1–3); Bryson p. 298–299).
17. Present the main results for continuous-time neighboring optimum control (Class notes (13), p. 1–4; Bryson, p. 317–318).
18. Present the essence of the bang-bang principle of a minimum time optimal control problem (Class notes (13)-second part, p. 1–4),
19. Present the essence of the minimum optima control effort problem (minimum fuel problem, bang-off-bang control), (Class notes (13)-third part, p. 1–3).
20. Discuss singular intervals in optimal control problem (Class notes (13)-fourth part, p. 1–5).