ME131 Vehicle Dynamics and Control

Lab 6: Longitudinal Dynamics: Model-Based Cruise Control

Assigned: 3/20/2019 Due: 4/5/2019, 11:59pm (On bCourses)

Please submit your homework solutions on bCourses as a single PDF of your solutions. When videos are required, please only submit the link as part of the solution PDF document. Late homeworks will be penalized.

Problem 1 Lab Deliverables (50pt)

1.1 (5pt) A plot of normalized time vs. velocity from Task 2.3. Include the β value.

1.2 (5pt) The C_d and R_x value from Task 2.4. Explain why the C_d is much higher than what one expects with a real, full-scale vehicle.

1.3 (5pt) Equation for the equilibrium point $F_{x,d}$ from Task 3.1.

1.4 (5pt) Linearized A and B matrices from Task 3.2.

1.5 (5pt) LQR gain from Task 3.3.

1.6 (10pt) Simulink model from Task 4.1.

1.7 (5pt) Plot of simulated vehicle's actual speed compared to reference velocity signal from Task 4.3.

1.8 (5pt) Plot of simulated vehicle's actual speed compared to reference velocity signal after adding sensor noise from Task 4.4.

1.9 (5pt) Explain why the controller is able to track the reference velocity perfectly without sensor noise, even with large disturbances from Task 4.5.