

Mid-Semester Group (4 members) Project
(Due ~ 10/10/2011 with 60 Minute Group Interview Quiz)

1. Develop the model for a motor (from volts to speed).
 - a) Develop the model that includes the motor inductance.
 - b) Develop a model that neglects the motor inductance. What is J_{eff} and b_{eff} ?
 - c) Look up the following values for the 12 volt maxon motor RE 40 (www.maxonmotor.com). Note any discrepancies in the published values.

	Values (Maxon's Units)	Values (SI Units)
K_b		
R		
K_I		
Stall Torque		
No Load Speed		
Mass Moment of Inertia		
b_θ		
Motor Time Constant		

- e) What are the eigenvalue(s) for the system (for both models)? What are the corresponding time constants?
 - f) Simulate the step response of the motor to an input voltage of 12 Volts. Compare the model that includes motor inductance and the model without the motor inductance (plot the speed output on the same graph). Explain the comparison.
 - g) How does the simulated system agree with the manufactures specification in terms of time constant and steady state velocity.
 - h) When is it reasonable (or not reasonable) to neglect the motor inductance?
 - i) Derive the equations of motion for the motor with a gearbox (with a gear ratio N)
- 2) Develop the model for vertical motion of your car (vertical motion only). The inputs should be a road profile (of vertical position and velocity) and a downward force on the vehicle.
 - a) Develop the model.
 - b) Pick a vehicle and determine the parameters for your model experimentally.
 - c) Where are the eigenvalues located? What is the corresponding damped and natural frequencies and damping ratio?
 - d) Simulate your suspension model to step inputs and compare to what you saw experimentally. Be prepared to discuss your tests and plots.