Homework Assignment #5

1. Compose a reading log for <u>three references</u> for your research paper, one for each article.

   <u>Reading log questions:</u>
   Before you begin reading all three articles…
   a) What is your purpose for selecting/reading this particular article/reference?
   b) How much time do you expect to spend reading and note-taking about each article?
   Based on an initial browse of each article…
   c) Outline major sections of the article.
   d) What research/inquiry questions will guide your reading of the article?
   e) What new vocabulary terms are introduced and what do these mean?
   f) What new equations/associated variables are introduced and what do these represent?
   Based on a more detailed read of each article…
   g) What are several new ideas/discoveries that emerged from your reading?
   h) Why are these significant? How do you know that these interpretations are correct?
   i) What tables/figures might you want to borrow to illustrate these? Why?
   j) What follow-up thoughts/questions were generated by reading this article?
   After you finish reading all three articles…
   k) How much time did you actually spending reading and completing the reading logs?
   l) What factors positively & negatively affected the quality of your reading?
   m) What actions could you take to improve your comprehension of technical articles?

2. Using an engineering analysis tool of your choosing (EES, MatLab, or Excel), develop a differential equation model and plot velocity and position versus time for the UI Hybrid Vehicle on a flat 75 meter track. Clearly document your equations and mathematical model. Monitor engine RPM, acceleration at the wheels, torque at the engine, and torque at the wheels. Do not allow the engine to exceed 12,000 RPM, although you may choose an engine speed lower than this as your shift point. Compare vehicle performance if the entire race is run in just 2^{nd} gear and just 3^{rd} gear.

   For extra credit: Explore different shift points for improved track time. Assume shift time is .15s. Thoroughly discuss assumptions/decision logic used in your model. A torque curve for the YZ250 engine is found on the course website if you want to create a customized torque function.

Parameter	**Value**
Frontal area	7 sq ft
Vehicle weight	725 lbf (includes 200 lb driver)
C_d	0.45
C_r	0.04
Driveline efficiency	85%
Wheel diameter	20 inches
Engine Torque @Max Torque	17 ft-lbf at 8500 RPM
Engine Torque @Max Power	15 ft-lbf at 10,000 RPM
Gear ratio (2^{nd} gear)	26.4 engine rev : 1 wheel rev
Gear ratio (3^{rd} gear)	20.1 engine rev : 1 wheel rev
Gear ratio (4^{th} gear)	15.7 engine rev : 1 wheel rev
Gear ratio (5^{th} gear)	12.3 engine rev: 1 wheel rev

3. If a fuel mixture can be represented by the general formula C_xH_{2x}, prove that the stoichiometric gravimetric air/fuel ratio is 14.8:1.

4. The dry exhaust gas analysis from an engine burning a hydrocarbon diesel fuel is as follows: CO_2 = .121, O_2=.037, N_2 = .842. Determine the molar composition of the fuel, the gravimetric composition of the fuel, the equivalence ratio of the fuel/air mixture under these sampling conditions, the fuel/air ratio on a mass basis under these sampling conditions, and the stoichiometric air/fuel ratio for this fuel.

5. Determine the adiabatic combustion temperature at <u>constant pressure</u> and at <u>constant volume</u> for two of the fuels of personal choice in the Heat of Reaction Activity. Graphically show that this corresponds to the product temperature where the heat of reaction is zero.