

Vehicle propulsion systems

TSFS03

HAND IN ASSIGNMENT 3

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1 Task 1:

Construct the Hamiltonian on paper, write down expressions for P_f and P_{ech} . Write down the whole Hamiltonian expression.

2 Task 2:

Using your Hamiltonian from previous task and Equation (3.2) in the compendium, what is the optimal time evolution of our equivalence factor, i.e. what is λ^* ? Please provide the answer with reasoning.

3 Task 3:

Using the `parallehybrid.m` from the dynamic programming exercise as base, complete `parallehybrid-ECMS.m`, i.e. given $[\omega_{ice}, \dot{\omega}_{ice}, T_{req}, \lambda]$ your script should return the optimal $[T_{ice}, T_{em}]$.

Write your complete solution here:

4 Task 4:

Complete the models for the electric motor and combustion engine in HEV-ECMS.mdl, parametrize the gear box and vehicle model so it corresponds to parallelhybrid.m. Add the figure of the model that you constructed with the table of all parameters that you used in this task.

What is the function of init-HEV-ECMS.m? Also implement checks to see that your controller does not violate any limits.

5 Task 5:

Find the optimal solution to the EUDC and City(ECE15) cycles using ECMS. What is the optimal $\lambda(t)$ for the different driving cycles?

Add the figure of SOC and velocity changes over time and write down your conclusion.

6 Task 6:

Compare the received solutions to the solutions from dynamic programming. Are there any differences? Computational time? (Answer all questions)

7 Task 7:

Use the driving cycles NEDC and FTP75.
First find the optimal $\lambda(t)$.

Secondly, do a sensitivity analysis on $\lambda(t)$, what happens if your open loop control is not perfect?

8 Task 8:

Given that the problem is unconstrained, the problem in equation (3.1) can be solved analytically. Solve the problem and find an expression for the λ . When are the derived controls applicable? When not?

9 Code

Insert your code here. Use sectioning to Separate the code of each task.