Energy Managment Strategies for Hybrid Electric Vehicles

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ABSTRACT : Coupled with the rapid quest of "Clean Generation" of electric energy is the rising demand for alternative energy source in urban mobility that can lessen the overall impact on air pollution. Hybrid electric vehicles, or HEVs, are the ideal option for utilising new energy sources since electricity can be generated through a high-efficiency transition in a system with electric motors and components. The authors of this study claim to demonstrate the use of a specific motion system, the joint system, in a simplified HEV model. In order to account for the JS's operation modes as well as the unique restrictions associated with the construction and design of a HEV, a unique energy management technique must be implemented. The appropriateness of rule-based control for the regulation of HEVs is proven in this application-oriented overview.
Keywords: Energy management, Hybrid electric vehicles, ICE, Induction generators, Power generation, Acceleration, Air transportation, Air pollution.

I.   INTRODUCTION

Ecological and economic considerations necessitate a thorough education on the fuel usage of all future autos. Conventional cars powered by internal combustion engines (ICEs) benefit from the extremely high energy density of gasoline or diesel fuel, but have a low part-load efficiency. Hybrid electric vehicles (HEVs) provide a possible option to significantly reducing fuel consumption while utilising current engine components. HEVs improve the overall efficiency by:

• Using energy under braking
• Using waste heat energy
• Additional supply by solar cells

• Improved mechanical energy transmission system
• Using super capacitors, fuel cells and new generation batteries

II.   METHODOLOGY

To achieve the above stated objectives, the following methodologies are to be used.
 A mathematical vehicle model will be developed and MATLAB simulation will be carried out for evaluation of power and energy requirements for a plug-in hybrid electric two-wheeler for different driving cycles.
A simple control strategy has to be developed for Indian city driving conditions with less fuel consumption for reducing emissions.
 A conventional two-wheeler will be converted into a plug-in hybrid electric two-wheeler by retrofitting a hub motor in the front wheel.
 Experiments will be carried out on engine and electric hub motor to estimate the power and torque requirements for various operating conditions.

III.   MODELING AND ANALYSIS

The aim of the research was to come up with new control techniques for a complete parallel hybrid electric powertrain that would reduce fuel consumption during the driving cycle. Dynamic programming was used to assess the global optimal solution in the first stage. This approach necessitates a thorough understanding of the driving cycle. As a result, the resultant control rules aren't instantly usable for real-time application. They are, nevertheless, extremely useful for benchmarking the performance of any other suboptimal but feasible control technique.
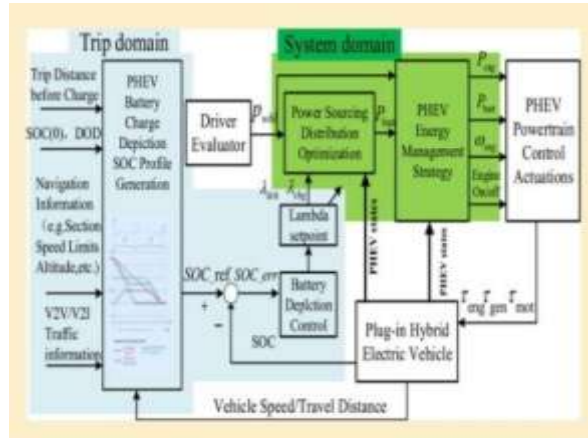
FIG. 1:- BLOCK DIAGRAM

IV. RESULTS AND DISCUSSIONS

Cycles of testing with elevation variations (FTPelv, US06elv, and SWISSelv). To ensure that both the ECMS and the pRSG-ECMS provide the same results on flat terrain, the settings for both techniques are equal. Table below contains a list of the parameters. The pRSG's extra parameters are shown in Table.

Table summarises fuel consumption and the relative excess consumption of the two causative techniques. In a mountainous setting, the pRSG-ECMS outperforms the ECMS significantly.

The fuel consumption using the pRSG-ECMS deviates from the ideal solution by less than 5.1 percent for the cycles tested here. The pRSG-ECMS produces nearly ideal fuel economy for the cycle US06elv. This is explained by the fact that the driving cycle maintains an almost constant speed near 60 km/h, which nearly matches the navigation system's estimation. Furthermore, the altitude profile of this driving cycle demonstrates a pretty regular road grade, climbing first, then dropping.

Table : Parameters for the pRSG-ECMS

SN.	Parameter	Value	Unit
1	$\eta recup$	0.7	-
2	ξmin	0.4	-
3	ξmax	0.7	-
4	$\delta\xi f$	0. 01	-
5	$\alpha\varepsilon$	10^8	S-2
6	$\alpha\varepsilon,f$	10^7	S-2

Table: Comparison of displacement of all 4 cases

V. CONCLUSION

By combining all above technologies, concepts and their improvements, we are slowly going towards energyefficient Hybrid Electric Vehicles which will greatly simplify our lives in the future.

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