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# RANDOM SEARCH IN ENERGY MANAGEMENT STRATEGY (EMS) FOR HYBRID ELECTRIC VEHICLES

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**Abstract.** - *The aim of this project is to optimize the total energy used (summation fuel and electricity) from vehicle utilization with the initial result in hybrid electric car (HEV) by using an optimization called Random Search Optimization. Nowadays, the developments of hybrid electric cars are not something new. There are a lot of research are being done on how to increase the effectiveness of hybrid electric cars. One of the main aspects that are being aim is to reduce the electricity consumption while increasing the HEV performance. This is for maintain or increase the HEV performance which is increase the efficiency. Thus, Random Search Optimization was applied to optimize the HEV source output which is from electricity system. This method also had already been applied to solve several other problems. But for HEV optimization more research is needed so that it can be applied for real HEV development in industry not for simulation purpose only.*

**Keywords:** HEV, Random Search, optimization

## 1. Introduction

Nowadays, hybrid electric vehicles (HEV) is used very popular among the car industries. The industries very busy to make sure their models are the best to sell for the customers based on their best energy management strategy of hybrid. All of the HEV need to improve energy management performances for make sure the car has high efficiency and economic for customers. This project proposes an energy management approach based on single agent optimization logarithm which is Random Search Method. The optimization objective is to minimize total energy cost for summation of fuel and electricity from vehicle utilization. The single agent optimization (Random Search Method) will increase the efficiency of the energy management strategy. Thus, the minimum optimization based on the Random Search Method will help the energy management strategy become smooth and economic for the fuel and electricity utilization. Therefore, the Random Search Method optimization needed in this limitation and the ideal way to solving all the problem and helpful in the application of this project. This project needed to comes with the understanding of the hybrid vehicle design through modeling, simulation, and optimization.

The basics rules to determine the base of the hybrid electric vehicle system need to be concern. Hybrid electric vehicle assumes an essential part in the automotive industries improvement for driving distance, low fuel utilization and pollution, driving cycles, and so on [1]. The battery execution for hybrid electric vehicle straightforwardly influences the performance of vehicle [2]. Hybrid Electric

Vehicles (HEV) offer many improvements over conventional vehicles in terms of a variety of societal and environmental benefits as implemented in a variety of demonstration, concept and production vehicles. Relative to conventional vehicles, these benefits include reduced vehicle and societal greenhouse gas emissions, reduced vehicle and societal petroleum consumption, reduced regional criteria emissions, improved national energy security, reduced vehicle fueling costs, and improved transportation system robustness to fuel price and supply volatility [1].

The implements to the HEV can be introduce for overall systems include the methods, developing key components, energy management strategy, drive cycles, optimization algorithms, economic analysis and decision making, system test and evaluation. As we know, every part of the parameters is need to determine before the optimization simulate because the parameters obtained the value that will changes when Random Search applied.

Based on the optimization approached, a simulation environment was developed to evaluate the changes. This study considered the power-split HEV type, which employs an electric continuously variable transmission (E-CVT). The HEV model consists of an ICE, two EMs, a battery, a regenerative brake system, vehicle resistance loads, a planetary gear set and a driver model, as shown in schematic diagram of power split type HEV simulation environment [7]. This parameters study will be compared with our model of the HEV power-split for fix with our model and objectives. The power-split can define as a controller because in every vehicle model's controller consists of