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HYBRID TRANSMISSION FOR MOBILE ROBOT

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ABSTRACT
This paper presents proposed designs of parallel hybrid transmissions with only one electric motor/generator (MG) and without any rotating clutches. The proposed motor/generator integrated hybrid transmission serves to regulate the engine's effective gear ratio (engine rotational velocity versus vehicle velocity) by mixing the engine and electric motor powers through a power controlling device. The proposed design provides some of the benefits and flexibility of a power-split design but using conventional available components in a simpler mechanical layout that makes the design compact, mechanically simple, and operationally flexible. Three commonly used transmission gear sets are used for this purpose; Simpson, Ravigneaux, and Type-6206 gear sets. With an electronic control unit, eight major modes of operation including a regenerative braking capability are shown to be feasible in the proposed hybrid transmission; one electric motor mode, two engine modes, two engine/charge modes, and two power modes. Continuously variable transmission (CVT) capability is provided with the second engine/charge mode and with the second power mode. The second power mode can be further subdivided into three hybrid sub-modes that correspond to the direct drive, under-drive, and over-drive of a conventional automatic transmission.
The feasibility of the proposed hybrid transmission is demonstrated with a numerical example employing conventional Ravigneaux gear train. The kinematics, static torque, and power flow relations for all operation modes are analyzed in detail.

1. INTRODUCTION AND LITERATURE REVIEW
A Hybrid System combines two motive power sources, such as an internal combustion engine and an electric motor, to achieve efficient driving performance.
A hybrid electric vehicle (HEV) achieves fuel economy, and improved performance by combining a smaller than normal engine with electric motor(s) and an energy storage system (ESS). The engine is smaller in displacement, or downsized, so that the average loads that the vehicle has to meet during acceleration and highway driving are closer to the engine's higher efficiency operating zones, represented in Fig. 1 by higher efficiency percentages [1].

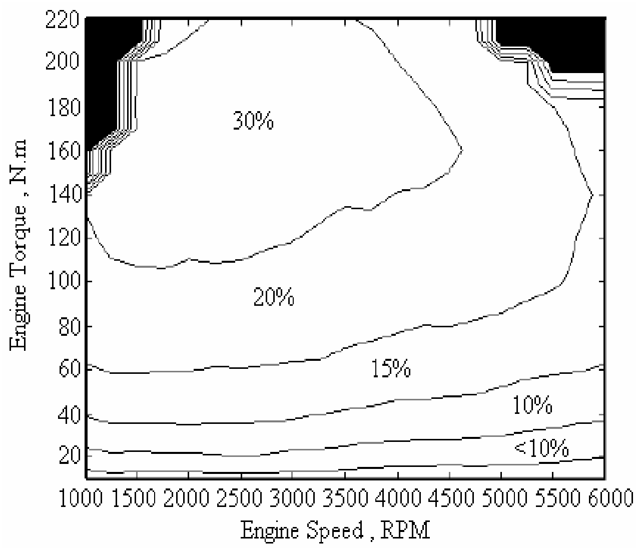

Figure 1: Typical engine efficiency map.

A HEV uses the electric motors and ESS to average the load on the engine, to achieve an efficient use of fuel. One or two electric motors are used in a variety of ways, depending on how they are connected to the vehicle power train [2]. Motors can provide a positive torque to drive the vehicle alone in the forward or reverse direction, or assist the engine during acceleration. One way to increase the average load and decrease fuel use is to shut off the engine when the vehicle load is small. Commonly this is referred to as engine idle stop, but the engine can sometimes be kept off for light accelerations and low cruising velocities.

