

Development of New e:HEV System for 2022 Model Year Hybrid Vehicle

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Honda has developed a new e:HEV system as the 2022 model year that greatly enhances fuel efficiency and driving performance compared with the previous system.

The key elements in the e:HEV system for enhancing vehicle performance are appropriate charging and discharging of the battery in accordance with each drive mode and efficient control of the engine operating point. This paper describes the energy management control technology that has enhanced fuel efficiency and driving performance compared with the previous system.

Like the previous system, the e:HEV system has the three drive modes of EV Drive, Hybrid Drive, and Engine Drive (Fig. 1), and performs control to automatically switch to the optimal drive mode in accordance with driver operations and the vehicle state. In the newly developed e:HEV system, enhancements have been made centering on the Hybrid Drive and Engine Drive modes.

In Hybrid Drive mode, when the engine starts because of the driver's intention to accelerate, Direct Accel Control is applied to actively use the battery power not for drive but to quickly increase the engine speed. By enhancing the power generation response of the engine in this manner, the time from pressing the accelerator to reaching peak G is shortened by approximately 1.5 sec. This realizes an enhanced driving force response to the driver's intention to accelerate. In addition, Linear Shift Control takes advantage of the feature that the engine speed can be freely selected and synchronizes the increase in vehicle speed with the change in engine speed. This produces a drive feeling that matches the senses and secures the needed power by dynamically operating the engine operating point in the torque direction, which realizes both a feeling of exhilaration and fuel efficiency performance (Fig. 2).

In Engine Drive mode, the vehicle drive shaft and the engine are directly connected, and the engine speed is correlated proportionally with the vehicle speed. In this drive mode, efficiency is enhanced by Torque Variable Control that constantly traces the point of optimum system efficiency with respect to driver operations. Seamless control of the engine torque in accordance with the power demanded by the driver and the vehicle speed reduces electrical loss in driving modes that include sudden acceleration and deceleration, reducing the battery heating value by approximately 3.9% and enhancing fuel efficiency performance by approximately 2.4%.

This energy management control makes active use of the torque direction of the engine, and thus the new e:HEV system is equipped with a newly developed 2.0L direct injection engine. This new engine achieves an expanded high thermal efficiency range compared with the 2.0L port injection engine of the previous model. The combination of advanced energy management control with the characteristics of the new engine produces "exhilarating" driving performance and achieves efficiency enhancement of approximately 2.7% in driving modes assuming practical use compared with the previous system.

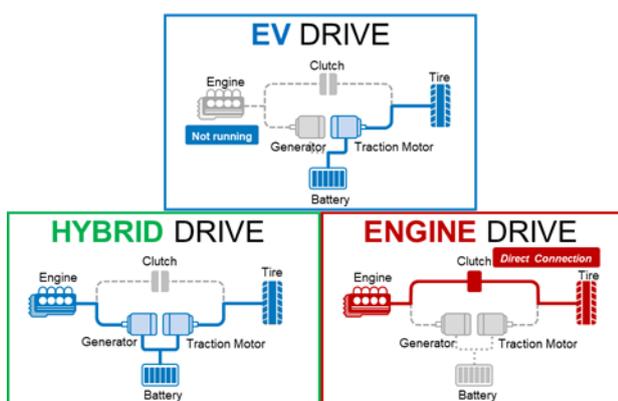


Fig. 1 Drive modes of hybrid system

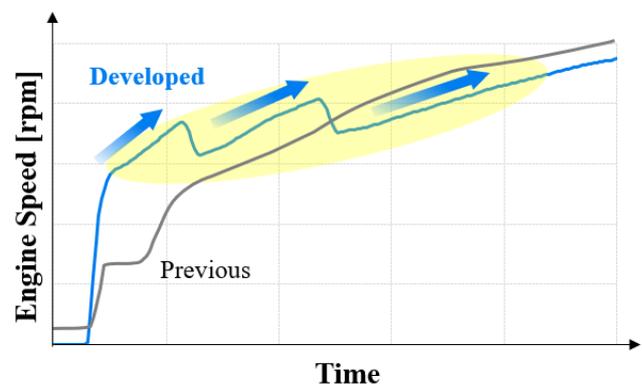


Fig. 2 Engine speed behavior during linear shift control