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New Development 1.8L Hybrid System for MPV

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Global warming and depletion of petroleum resources are becoming more serious worldwide, and it is hoped that carbon neutrality in automobiles will be realized as soon as possible. As a practical solution for the popularization of electric vehicles, we have newly developed a 1.8L hybrid system and installed it in the new NOAH and VOXY. As a result, not only the top fuel efficiency of the compact cab wagon, but also a direct and smooth driving feel and power supply for advanced computerization have been realized. In addition, in order to meet the needs of various customers, including snowfall areas, we have set up an e-4WD system that was newly developed like the main system.

The purpose of developing a new system is to achieve the fuel efficiency standards 10 years from now and to achieve a driving feel that is typical of electric vehicles. Therefore, all the electric units have been renewed to achieve thorough efficiency and output. It's adopts, motor with 16% higher output than the previous model, breakthrough downsized hybrid transaxle filled with new low viscosity oil, Li-ion battery with expanded input and output power in small size and light weight, PCU with new power semiconductor and new drive circuit with reduced electrical noise. The control technology has also been renewed in order to operate these electric units optimally. Unit specifications are shown in Table1.

Table1 Unit specifications

		New Noah/Voxy	Previous Noah/Voxy	Current Prius
HV System				
	Power(kW)	103	100	90
Engine				
	Power(kW)	72	72	72
	Torque(Nm)	142	142	142
Motor				
	Power(kW)	70	60	53
	Torque(Nm)	185	207	163
	Max rpm	17000	13500	17000
Battery				
	Type	Li-ion	Ni	Li/Ni
	Cell number	56	168	56/168
	Rated Voltage(V)	207.2	201.6	207.2/201.6
	Battery Capacity(Ah)	4.08	6.5	3.59/6.5

As a result, 0-100km/h acceleration time is reduced 6% versus the previous model, and the acceleration feel of the intermediate accelerator has also been improved. We were able to obtain a response that outputs the driving force immediately when the accelerator pedal is depressed, and a characteristic that the driving force is sustained even if the vehicle speed increases.

The engine used is the current Prius, and the thermal efficiency has been improved from 38.5% to 40% by improving the piston and lowering the friction of the valve train compared to the previous model. For the hybrid system, in addition to unit technologies described above, optimization of engine intermittent start / stop timing and battery charge / discharge energy, and reduction of boost frequency are adopted. As a result, the transmission loss of the hybrid system has been reduced by 11% compared to the previous model, achieving class-leading fuel efficiency.

It was the first NOAH and VOXY to be equipped with an e-4WD system. In order to ensure sufficient climbing performance even with heavy vehicle weight, the rear drive motor was changed from the induction motor of the current Prius system to a permanent magnet motor to significantly improve torque and output. Based on the improved motor performance, the 4WD operating range has been expanded to medium and high speeds and turning, in addition to when starting and accelerating, contributing to the improvement of safety and drivability low friction roads. In particular, the turning performance is the same as that of SUV by adopting a new feedforward control that inputs the vehicle speed, steering angle, and accelerator in addition to the conventional feedback control. (Fig.1) Also, by improving the structure and oil of the rear transaxle, the difference in fuel efficiency with the 2WD model could be minimized.

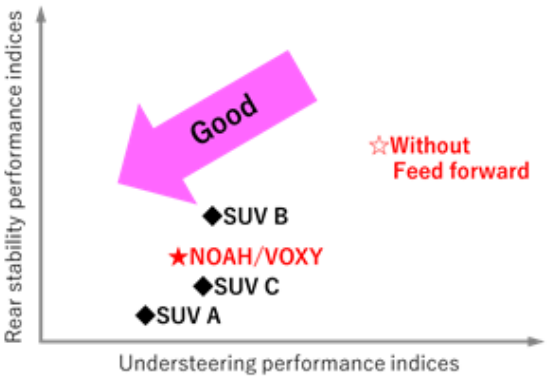

Fig.1 Line trace performance when turning