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Road condition simulation control in vehicle bench testing using a flat-type dynamometer

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Vehicle bench testing is conducted using chassis dynamometers and hub dynamometers as an alternative to on-road testing, where driving and environmental conditions are difficult to repeatedly reproduce.

Traditionally, bench testing has involved converting the vehicle weight, known as electrical inertia, into rotational inertia and adding this to the dynamometer's mechanical inertia. This is a control method that treats the entire combination of the test vehicle and dynamometer as a rotating body with one degree of freedom, and is used to measure fuel and electricity consumption during various driving modes and to evaluate powertrains. However, model-based development has become more common in vehicle development in recent years, and a method known as VILS (Vehicle-in-the-loop Simulation) is now being used.

In this paper, we report on the results of evaluating traction control and ABS by linking a vehicle model with a flat-type dynamometer we have developed that can be installed inside a vehicle's tire house to simulate and control road conditions.

Figure 1 show the photographs of the developed 94kW dynamometer, and Figure 2 shows a control block diagram of a dynamometer used to simulate road surface conditions for a front-wheel drive vehicle. Figure 3 shows a photograph of the dynamometer mounted on a BEV, and Figure 4 shows the vehicle speed, wheel speed, and slip ratio when the ABS is activated on this vehicle.

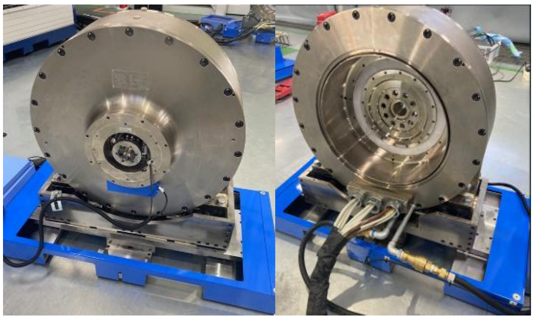

Fig.1 94kW flat-type dynamometer

Fig.3 Vehicle equipped with 94kW flat-type dynamometer

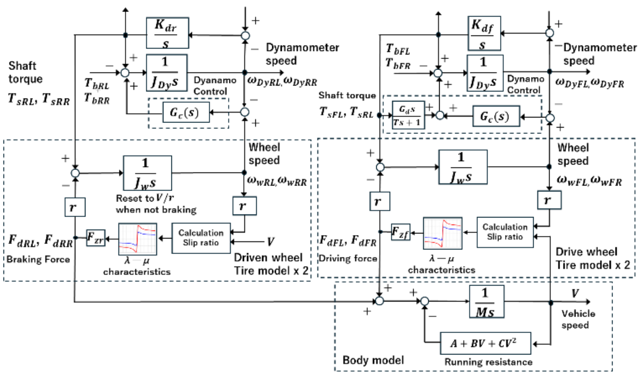

Fig.2 Block diagram of dynamometer control (FWD)

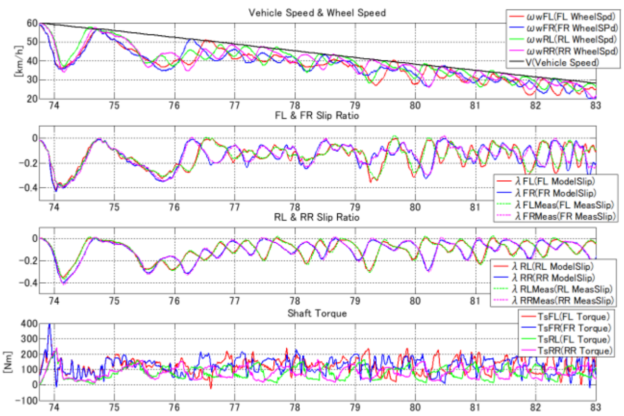

Fig.4 ABS evaluation at μ max=0.1