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A Study on Real Driving Emissions Measurement Test Method by Using Driving Robot for Passenger Vehicles

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Vehicle fuel consumption and exhaust gases during actual operation differ from the values listed in the manufacturers' specifications. Real driving emission (RDE) tests on diesel and gasoline vehicles have been performed in Europe since 2018 with the goal of improving air quality; however, in Japan, RDE tests targeting NOx in diesel vehicles will start in October 2022. At Japanese RDE test, it is possible to drive the test vehicle at test course (TRIAS (Test Requirements and Instructions for Automobile Standard) 31-J119-01). When we drive the test vehicle at test course, we have to follow the reference vehicle velocity pattern as well as Chassis dynamometer test method. However, it is difficult to measure the correct emissions data and to drive safety when we drive the test vehicle at test course while following the test pattern.

In this study, to obtain more correct RDE data, we adopted the driving robot, which is consist of the compact size and the simple simulation logic of the driving operation. Figure 1 is showed the driving robot. Left-side figure is the commercial robot (TYPE-i: Meidensha) and right-side figure is the self-product robot. The weight of the commercial robot is about 200kg. On the other hand, the self-product robot is about 30kg. So, self-product robot is possible to carry and to set into the test vehicle easily. And the robot oration model is very simple structure. Therefore, the self-product robot doesn't need the teaching, which use the accelerate map, brake map and the demand torque map. So, RDE test at test course is started soon after the driving robot is set into the test vehicle. Figure2 is setting the robot in the test vehicle. This robot uses the GPS system, which is obtained the vehicle speed. The control panel (master) calculates the accelerator and brake operating condition, by using the reference speed and the feedback speed (GPS).

Figure3 is RDE test result. Test vehicle is the series hybrid passenger vehicle. Test mode is WLTC (low and middle phase) and hot start. Test driver is the robot, human-A and human-B. Under this condition, we measured the electric power consumption of motor. The result is that the electric power consumption by the human driving is increased, compared to the Robot driving at the test course. The result of the Robot driving at the test course is similar to operate at chassis dynamometer test. However, driver of human is difficult to follow the vehicle speed pattern at test course. The reason is that the driver is checking the road and the vehicle speed pattern, and operating handle, accelerator and brake pedal at the conventional RDE test driving at test course. Therefore, the result RDE data of human driving at test course is not able to obtain the correct emission at RDE test.

In conclusion, by using this driving robot, it was possible to keep the equity, efficiency and safety at RDE test.

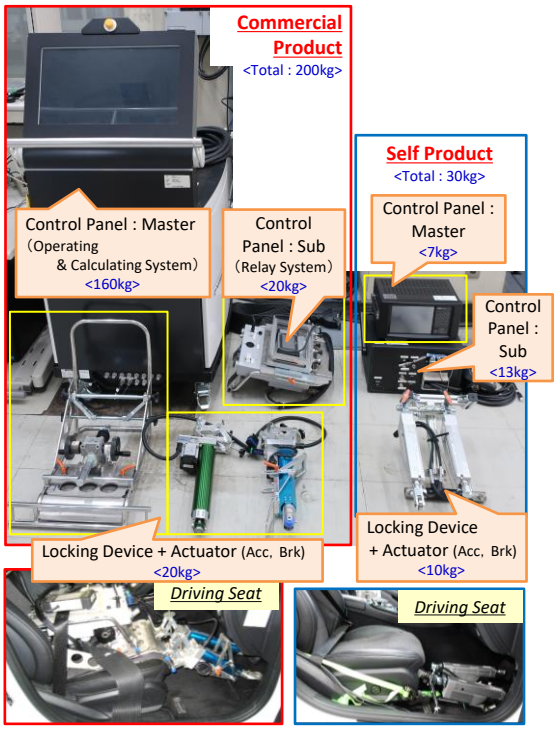

Fig.1 Driving Robot (Commercial Product, Self Product)

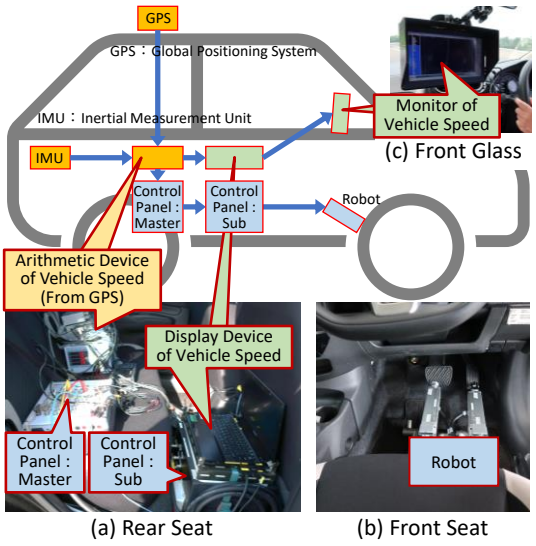

Fig.2 Setting of Driving Robot in Test Vehicle for RDE Test

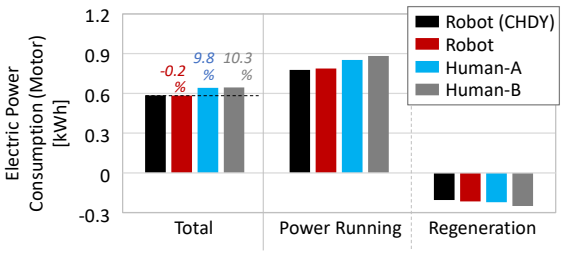

Fig.3 Electric Power Consumption at Driving Test Course (WLTC: LM, HEV)