



Configurable Transmission Test Stand Enables Testing of Multiple Drivetrain Configurations

The Challenge

A major automotive manufacturer required a complete transmission test bed that was reconfigurable for multiple drivelines. They would be performing testing and validation of four-, five- and six-speed transmissions. They required complete simulation of the engine, including torque pulses, and they also needed to simulate the vehicle drive wheels, including wheel slip. The test bed also needed to provide accurate reproductions of driveline dynamics under all driving conditions, supporting both road load simulation, and noise, vibration and harshness investigations.

The A&D Solution

To achieve the low inertias required to accurately represent the vehicle's engine and wheels, a series of three high-performance permanent magnet (PM) motors were specified. A 370 kW PM motor with an offset rotor was selected to simulate the engine input into the transmission. The offset rotor allows the driveshafts to be connected to the transmission and output dynamometers without the use of half shafts or other apparatus which can actually introduce new vibrations, thus providing conditions as close to the actual vehicle as possible.

Two 400 kW PM motors were used to simulate the load created by the vehicle's tires. All three motors are mounted to moveable bases, facilitating easy reconfiguration of the test rig to accommodate different transmission and drivetrain combinations. Power for all three dynamometers is controlled by a single high-performance AC drive with three inverters. This configuration is optimum for complete coordination of power and switching frequencies, allowing the system to accurately reproduce the vehicle's drivetrain on the test rig.

Transmission testing requires highly sophisticated simulation, modeling and control capabilities. The test system must monitor the communications between engine (ECU) and transmission (TCU) controllers, interpret commands, calculate and send the set point information to the AC drive. For this application the time allotted for this entire process was eight milliseconds, the response time between the ECU and the TCU.

To achieve this level of performance, A&D used their Andromeda advanced dynamometer controller running on the Procyon high-performance simulation and modeling platform. Andromeda provided the modeling environment to store and run multiple vehicle drivetrain models. While the Procyon system provided the computational power to simulate the ECU, run the Andromeda application, perform the complex simulation algorithms and close the ECU, TCU, AC drive loop in less than two milliseconds.

Transmission Test Stands

Application Story



All test cells contain other systems requiring controls, such as fluid conditioners, safety systems, operator interface, test configuration and facilities interfaces. A&D's iTest data acquisition and control system, in combination with the iConnect distributed I/O, provided the overall test cell facilities interface and supervisory control. iTest is also where the actual test sequences are authored and executed.

Added Reward

A&D's experience and consultative problem solving provided the customer a sophisticated transmission test system which can be expanded to deliver more capability as future demands grow. From the customer's perspective, A&D's solution not only met all their requirements, but exceeded some as well.

"Because the test cell uses a simulated engine to run the transmission, we saved on facilities cost by avoiding the need for fuel, explosion and sound proofing, and emissions controls. We now have a flexible transmission test rig that will effectively test many different driveline configurations. We can also use it for competitive evaluation, NVH, durability and efficiency testing."



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