

## Tuning for a Small Engine with a Supercharger

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**Abstract :** The formula project of Kinki University has been involved in the student Formula SAE of Japan (JSAE) since the second year the competition was held. The vehicle developed in the project uses a ZX-6R engine, which has been manufactured by Kawasaki Heavy Industries for the JSAE competition for the eighth time. The limited performance of the concept vehicle was improved through the development of a power train. The supercharger loading, engine dry sump, and engine cooling management of the vehicle were also enhanced. The supercharger loading enabled the vehicle to achieve a maximum output of 59.6 kW (80.6 PS)/9000 rpm and a maximum torque of 70.6 Nm (7.2 kgf m)/8000 rpm. We successfully achieved 90% of the engine's torque band (4000-10000 rpm) with 50% of the revolutions in regular engine use (2000-12000 rpm). Using a dry sump system, we periodically managed hydraulic pressure during engine operation. A system that controls engine stoppage when hydraulic pressure falls was also constructed. Using the dry sump system at 80 mm reduced the required engine load and the vehicle's center of gravity. Even when engine motion was suspended by the electromotive force exerted by the water pump, the circulation of cooling water was still possible. These findings enabled us to create a cooling system in accordance with the requirements of the competition.

**Keywords :** engine, combustion, cooling system, numerical simulation, power, torque, mechanical super charger

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