

Development and simulation of dry multi-plate clutches for automotive applications

This project focuses on the development of new approaches that support the application of dry multi-plate clutches as a substitution to conventional wet multi-plate clutches in passenger vehicles.

A substitution is intended mainly for efficiency improvements of the clutch and in further consequence of the vehicle, for an omission of the oil and a reduction of required plates. In the development process, different friction materials and clutch designs are tested in the vehicle, as well as on the test bench, in order to fulfil the high requirements regarding torque transmission potential, torque accuracy, wear, NVH and thermal behaviour.

For test bench investigations, an innovative test bench is built up and specially adapted to perform tests at different loading and ageing conditions of the clutch, to characterise the

clutch and different linings and carry out investigations on the above-mentioned issues. Unfortunately, the dynamic behaviour and occurring phenomena of multi-plate clutch systems often cannot be understood or measured satisfactorily, neither on the test bench nor in the vehicle.

For this reason, simulation models have to be provided, which are able to simulate the internal processes, as well as the holistic behaviour of multi-plate clutch systems. The development of such a simulation model represents the core contribution of this project.

The innovative approach presented, which is implemented in self-developed simulation models, opens the possibility to simulate dynamic effects of multi-plate clutches, like axial force loss or varying coefficients of friction under different load and operating conditions for each time step of clutch simulation •

