

Vehicle Stability Control with Modular Hydrostatic Wheel Drives

Clemson University - International Center for Automotive Research
Beshah Ayalew

This research concerns the investigation of Vehicle Stability Control (VSC) strategies involving novel independent torque management systems for future electric, electric-hybrid, or hydraulic hybrid vehicles. Independent wheel drive systems were studied in depth to directly modulate drive torques separately for each wheel so as to eliminate or significantly reduce the activation of the friction brakes. In particular, this work focuses on hydraulic hybrid vehicles with multiple drive units that can modulate drive torque to all four wheels independently. Independent drive means that when a net corrective yaw moment has to be generated to stabilize the vehicle and/or accommodate driver intent, the function can be realized by reducing the drive torque on one wheel and increasing it on another. This provides opportunities for optimizing energy re-distribution within the vehicle instead of wasting it as heat in the friction brakes. A successful implementation and control of such independent drive systems must consider both powertrain efficiency constraints and vehicle stabilization objectives simultaneously. In other words, the driving torque distribution strategy must explicitly consider a real-time optimization of appropriately formulated objectives for a safe, good handling vehicle which meets its basic environmental and energy efficiency goals of a hydraulic hybrid vehicle.