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Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies

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The collaborative research of the University of Toledo and University of Detroit Mercy is based on an experimental setup that is currently being developed at the University of Toledo. This test stand makes it possible to evaluate the performance of dual-function hydraulic pump/motors as the main components of the hydraulic hybrid vehicles. The investigating group from the University of Toledo and University of Detroit Mercy are collaborating to develop education modules as well as educational simulations around this test stand. To this end, experiments and simulations are being designed in the form of complete modules to teach Engineering students the fundamental concept of the hydraulic hybrid vehicle technology. These modules have elements from the core courses of the Mechanical Engineering curriculum. At the University of Detroit Mercy, a rudimentary Simulink model (assuming ideal behavior) for the accumulator, pump/motor, and a simple flywheel load have been completed. The next steps are to fill in the engine, transmission, and road load components, to account for inefficiencies, and also to model conventional and electric hybrid drivetrains for comparison. These modules will be used to enhance the students' learning in fluid dynamics, hydraulics, energy systems, vibrations, mechatronics, and controls. The hydraulic hybrid test stand is being constructed at the University of Toledo.