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Kinematics and nonlinear control of an electromagnetic actuated CVT system for passenger vehicle (Article)

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Abstract

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An electromagnetic actuated continuously variable transmission (EMA-CVT) system is developed by two sets of electromagnetic actuators (solenoid) located on primary and secondary pulley. A set of solenoids are attached to the primary and secondary pulley to develop the attraction and repulsive forces. The relationships between the speed ratio and electromagnetic actuation and clamping force and output torque of the CVT are established based on the kinematics of the EMA-CVT system. A fuzzy logic controller (FLC) is developed to control the EMA precisely based on the feedback of the RPM sensor and slope sensor. The EMA-CVT performance with controller has found 28% more than the performance of the EMA-CVT without controller. The solenoids of the EMA were activated by varying the current supply with the Fuzzy-Proportional-Derivative-Integrator (FPID) to maintain the non-linearity of the CVT in response of the vehicle traction torque demand. Result shows that the solenoid is able to pull the plunger in the desired distance with supply current of 12.5 amp while push the plunger to the desired distance with 14.00 amp current supply to the windings when the vehicle is considered in 10% grade. The acceleration time of the 1/4 scale car has been recorded as 5.5 s with the response of drive wheels torque. © 2012 The Korean Society of Mechanical Engineers and Springer-Verlag Berlin Heidelberg.

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