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Development of a mode shift control algorithm for a dual mode power split type hybrid electric vehicle with on/off type clutch and brake

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This paper presents a mode shift control algorithm for a dual mode power split type hybrid electric vehicle (HEV) with on/off type clutch and brake. The investigated dual mode power split type HEV consists of an engine, two motor-generators (MG1 and MG2), two planetary gear sets, on/off type (dog type) clutch and a brake. The target dual mode HEV requires 4 mode shifts: 1) Electric vehicle (EV) mode to input split mode, 2) input split mode to compound split mode, 3) compound split mode to input split mode, 4) compound split mode to EV mode. To evaluate the shift performance of the HEV, dynamic models for the HEV powertrain were developed. Using the dynamic models, a mode shift performance simulator was developedand mode shift performance simulations were performed. To analyze the transient shift characteristic of the target HEV, Bondgraph models for the transient shift state from the input split mode to compound split mode were constructed and shift dynamic equations were derived. Based on the shift dynamic equations, a mode shift control algorithm which determines the demanded torque of the engine, MG1 and MG2 during the mode shift was proposed to obtain improved shift quality (SQ). The proposed control algorithm consists of a) Engine control, b) MG1 control and b) MG2 control. Performance of the mode shift control algorithm was evaluated using the simulator. From the simulation results, it was found that the target HEV which applied the on/off type clutch and brake can satisfy the required SQ by the cooperative control of the engine, MG1 and MG2 torque.

Biography

Sungwha Hong has completed his Bachelor's degree in Mechanical Engineering from Sungkyunkwan University, Korea in 2011. He is currently working towards PhD degree at Sungkyunkwan University. His research interests include modeling, design and control of the powertrain system for the hybrid electric vehicle and electric vehicle.

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