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Chassis Level Control Using Proportional Integrated Derivative Control, Fuzzy Logic and Deep Learning

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Abstract : This study presents the design and implementation of an experimental chassis-level system for various control applications. Specifically, the height level of the chassis is controlled using proportional integrated derivative, fuzzy logic, and deep learning control methods. Real-time data obtained from height and pressure sensors installed in a 6x2 truck chassis, in combination with pulse-width modulation signal values, are utilized during the tests. A prototype pneumatic system of a 6x2 truck is added to the setup, which enables the Smart Pneumatic Actuators to function as if they were in a real-world setting. To obtain real-time signal data from height sensors, an Arduino Nano is utilized, while a Raspberry Pi processes the data using Matlab/Simulink and provides the correct output signals to control the Smart Pneumatic Actuator in the truck chassis. The objective of this research is to optimize the time it takes for the chassis to level down and up under various loads. To achieve this, proportional integrated derivative control, fuzzy logic control, and deep learning techniques are applied to the system. The results show that the deep learning method is superior in optimizing time for a non-linear system. Fuzzy logic control with a triangular membership function as the rule base achieves better outcomes than proportional integrated derivative control. Traditional proportional integrated derivative control improves the time it takes to level the chassis down and up compared to an uncontrolled system. The findings highlight the superiority of deep learning techniques in optimizing the time for a non-linear system, and the potential of fuzzy logic control. The proposed approach and the experimental results provide a valuable contribution to the field of control, automation, and systems engineering.

Keywords : automotive, chassis level control, control systems, pneumatic system control
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