

Design and Analysis of Full-state Feedback Controller for a Tractor Active Suspension: Implications for Crop Yield.

Abstract

Vehicle suspension systems are needed in modern tractors to improve ride comfort by insulating driver's cabin from road disturbances. Active suspension (AS) systems have the potential to improve both ride quality and handling vibration performance upon use of feedback to control its hydraulic actuator. This gives a capability to the vehicle to continuously adjust itself and response to the varying road conditions. The main objective of this study was to use a full-state feedback approach to design and analysis of AS control system for Kubota M110X tractor to eliminate the transmitted vibrations to the driver's cabin caused by field roughness. The inputs of the system were determined as the control force generated from the hydraulic actuator of the AS and the road disturbances caused by holes and uneven surface. A simulation model was developed to analyze the behavior of the system to disturbances with 0.25 m amplitude. Results are included to show the dynamic performance and robustness of the proposed controller in dissipating the corresponding disturbance vibrations for a comfort ride with an instant overshoot of about 12% of the inputs disturbance and a settling time (ST) of 4.36 sec.

Keyword: active suspension, controller, tractor, state feedback, simulation