

PUBLIC ABSTRACT

Brian F. Bax

MSME

Mechanical and Aerospace Engineering

Dr. Roger Fales

May 2006

APPLYING AND ANALYZING ROBUST MODERN CONTROL ON UNCERTAIN HYDRAULIC SYSTEMS

Advanced hydraulic systems provide for better performance and fuel efficiency than classic hydraulic systems. However, these advanced systems require a level of control that is more intensive than classical control techniques. Also, these advanced hydraulic systems have many unknown or uncertain characteristics that must be accounted for. This research involved creating a mathematical model of the hydraulic system and validated it against test data from an actual machine. Once this model was created, a classical controller was created to serve as a baseline for comparison. Three types of advanced controllers were then applied and examined: Mixed Sensitivity control, MacFarlane-Glover H_∞ Loop-shaping and Two Degrees-of-freedom H_∞ Loop-Shaping. By examining the performance of each control under different cases, a general statement about robustness could be made. Robustness means how well the controller can replicate its performance whether the system is changing or not. It was found that all three advanced controller provided better robustness but only the Two Degrees-of-freedom H_∞ Loop-shaping provided better performance and robustness than the classical controller. This implies that this advanced control system is appropriate for these advanced hydraulic systems. This controller type can then be applied more easily to the system making them feasible for production.