Fuzzy Logic Controllers for Electro-Hydraulic Servo-Actuators

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Abstract— The paper presents two fuzzy logic controllers used for electro-hydraulic servo-actuators command. The first is a Mamdani proportional controller with seven membership functions both on input and output and the second is a Sugeno controller also with seven membership functions on input and output. One follows the possibility to obtain good performances for the servo-actuator with each fuzzy controller. The aim is to obtain a response time as short as possible, but to avoid the auto-oscillations of the servo-actuator. An aperiodic response is desired. Also, the bias current of the servo-valve is compensated using a global translation for the output membership functions. One observed a convenient modification of the control surface using the modification of the input membership function. This modification is easier to be obtain in for the Sugeno controller then for the Mamdani controller. It is preferable to obtain a greater slope of the control surface for large values of the error signal and smaller slope near the origin. By this way it is possible to avoid the servo-actuator auto-oscillations. The mathematical model used for the servo-actuator is a nonlinear with mass flow ratios which ensures a better stability and precision in the numerical simulations. The results obtained with this mathematical model are more realistic than those with linear signals, for any input signals.