

# A Switching Adaptive VSS/Fuzzy Control

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## Abstract

In the field of adaptive fuzzy control, there has been a severe deficiency by assuming the premise variables will usually stay within the universe of discourse in the derivation of stability of the adaptive control system. To overcome this deficiency, we develop a switching adaptive control scheme using only essential qualitative information of the plant to attain asymptotical stability of the adaptive control system for a typical first-order nonlinear system without imposing the mentioned severe assumption. The switching adaptive control system consists of an adaptive VSS controller for coarse control, an adaptive fuzzy controller for fine control, and a hysteresis switching mechanism. An adaptive VSS control scheme is proposed to force the state to enter the universe of discourse in finite time. While the premise variable is within the universe of discourse, an adaptive fuzzy control is proposed to learn the capability to stabilize the plant. At the boundary of the universe of discourse, a hysteresis switching scheme between the two controllers will be proposed. We show that after finite times of switching, the premise variables of the fuzzy system will remain within the universe of discourse and stability of the closed-loop system can be attained by applying Lyapunov direct method.

Keyword : Adaptive fuzzy control, Adaptive VSS control, Hysteresis switching mechanism