



# Discrete-time variable structure control of buildings with fuzzy adaptive regulation of reaching law

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## Abstract

In the study, based on the advantage of fuzzy control method, a new discrete-time variable structure control method involving fuzzy adaptive regulation of reaching law has been applied for seismically excited building structures. The undue chattering effect, which is generally acknowledged as the major disadvantage of variable structure controllers, has been avoided by introducing this new method without losing the robustness against parametric uncertainties and modeling inaccuracies. In the paper, we explain in detail the application of the discrete-time variable structure control method to the control of seismologically excited structural systems. The control system is first transformed into standard discrete form. Then the discrete switching surface is determined by using ideal quasi-sliding mode and discrete controller is designed by using the fuzzy adaptive regulation of reaching law. Finally we give numerical simulations for MDOF (Multiple-Degree-of-Freedom) shear building model containing an active brace system; and the simulation results show preliminarily that the new control method is quite effective: not only can it reduce the peak-response of the ground motion, but also it can keep the chattering effect sufficiently low so as to ensure the system stable.

**Key words:** Fuzzy control, Discrete-time variable structure control, Chattering effect, Reaching law

## 1. Introduction

In the field of civil engineering, many different techniques for actively controlling vibrations of seismically excited structure have been developed and applied to civil structures. Active control system reduces the structural

response by using external energy supplied by actuators to impart forces on the structures, generally depending on a sizeable power supply. It is considerably more flexible to reduce the structural responses for a wide variety of loading conditions. Although in the past researches of civil structures were often treated separately, the fields have now been interfaced to combine two or more algorithms