

# Accepted Manuscript

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PII: S0016-0032(17)30395-2  
DOI: [10.1016/j.jfranklin.2017.08.022](https://doi.org/10.1016/j.jfranklin.2017.08.022)  
Reference: FI 3105

To appear in: *Journal of the Franklin Institute*

Received date: 21 December 2016  
Revised date: 25 May 2017  
Accepted date: 10 August 2017

Please cite this article as: Jian Zhang, Xiaowu MU, Yungang Liu, Global Adaptive Regulation of Stochastic High-order Nonlinear Systems with Unknown Control Direction, *Journal of the Franklin Institute* (2017), doi: [10.1016/j.jfranklin.2017.08.022](https://doi.org/10.1016/j.jfranklin.2017.08.022)



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# Global Adaptive Regulation of Stochastic High-order Nonlinear Systems with Unknown Control Direction

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## Abstract

In this paper, the global adaptive regulation is considered for a class of uncertain stochastic high-order nonlinear systems with serious nonlinearities and unknowns. For details, the considered systems admit the general forms which include the strict-feedback systems as the special case, and allow the more complicated nonlinearities. Moreover, the system model suffers from both the unknown parameterized nonlinear growth conditions and the unknown time-varying control gain with unknown control direction (i.e. the sign of the control gain). By introducing two new design parameters and skillfully combining the adaptive design methods with the Nussbaum-type function based technique, a desired adaptive regulation control scheme is successfully presented, by which the obtained smooth controller can effectively guarantee that all the closed-loop system states are bounded almost surely, and especially the original system states converge to the origin with probability one. Finally, to demonstrate the feasibility of the control scheme, a numerical example is given.

**Keywords:** Stochastic high-order nonlinear systems, unknown control direction, unknown parameterized nonlinearity, Nussbaum-type function, global adaptive regulation.

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