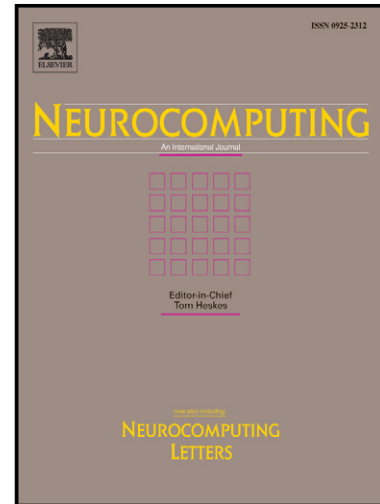


Author's Accepted Manuscript

Neural Network Based Dynamic Surface Control of Hypersonic Flight Dynamics Using Small-gain Theorem

Bin Xu, Qi Zhang, Yongping Pan



www.elsevier.com/locate/neucom

PII: S0925-2312(15)01164-9
DOI: <http://dx.doi.org/10.1016/j.neucom.2015.08.017>
Reference: NEUCOM15940

To appear in: *Neurocomputing*

Received date: 6 June 2015
Revised date: 2 August 2015
Accepted date: 5 August 2015

Cite this article as: Bin Xu, Qi Zhang, Yongping Pan, Neural Network Based Dynamic Surface Control of Hypersonic Flight Dynamics Using Small-gain Theorem, *Neurocomputing*, <http://dx.doi.org/10.1016/j.neucom.2015.08.017>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Neural Network Based Dynamic Surface Control of Hypersonic Flight Dynamics Using Small-gain Theorem

August 12, 2015

Bin Xu^{1*}, Qi Zhang^{1,2}, Yongping Pan³

1. School of Automation, Northwestern Polytechnical University, Xi'an, China, 710072

2. National Key Laboratory of Aerospace Flight Dynamics, Northwestern Polytechnical University, Xi'an, China, 710072

3. Department of Biomedical Engineering, National University of Singapore, Singapore

Abstract: This paper analyzed the neural control for longitudinal dynamics of a generic hypersonic aircraft in presence of unknown dynamics and actuator fault. For the attitude subsystem, direct adaptive design is presented with the dynamic surface design and the singularity problem is removed. For actuator fault, the unknown dynamics caused by fault is approximated by neural networks. The highlight is that the minimal-learning-parameter technique is applied on the dynamics and the simpler adaptive algorithm is easy to implement since the online updating computation burden is greatly reduced. The uniform ultimate boundedness stability is guaranteed via Small-gain Theorem. Simulation result shows that the controller could achieve good tracking performance with minimal learning parameter in case of actuator fault.

Index Terms – hypersonic flight vehicle, dynamic surface control, small-gain theorem, neural network, minimal learning parameter

Nomenclature

$C_D(\alpha)$ = drag coefficient

$C_D^{\alpha^i}$ = i th order coefficient of α contribution to $C_D(\alpha)$

C_D^0 = constant term in $C_D(\alpha)$

$C_L(\alpha)$ = lift coefficient

$C_L^{\alpha^i}$ = i th order coefficient of α contribution to $C_L(\alpha)$

*To whom all correspondences should be addressed.

Download English Version:

<https://daneshyari.com/en/article/10326408>

Download Persian Version:

<https://daneshyari.com/article/10326408>

[Daneshyari.com](https://daneshyari.com)