



SDI Review Form 1.6

Journal Name:	Asian Research Journal of Mathematics
Manuscript Number:	Ms_ARJOM_47394
Title of the Manuscript:	Adaptive Control of A Four-Dimensional Hyperchaotic System
Type of the Article	Original Research Article

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound. To know the complete guideline for Peer Review process, reviewers are requested to visit this link:

(<http://www.sciencedomain.org/page.php?id=sdi-general-editorial-policy#Peer-Review-Guideline>)

PART 1: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
Compulsory REVISION comments	<p>1. The state variables shown in Eq.(1.1) should be explained in the sense of physical aspect. Moreover, the specific reason to adopt the w state needs to be rectified.</p> <p>2. An overall control block-diagram is required to understand the objective of control action.</p> <p>3. How to select the numerical values given in Eq. (2.1)?</p> <p>4. What is the most significant difference between 3D problem and 4D problem? In other words, what is the most difficult issue to be resolved in 4D problem? This should be clearly addressed to assert the technical contribution of this work. This reviewer see 3D view only from Figure 3.</p> <p>5. What is the dimensional unit of time in the x-axis? Is it non-dimensional?</p> <p>6. Control input history needs to be presented to achieve control results shown in Figures 4 and 6.</p>	<p>The authors thank the reviewer's valuable comments and suggestions. We agree with the reviewer. All the corrections of the revised manuscript are highlighted in yellow.</p> <p>We have explained the state variables and the given numerical values in Eq. (2.1), rectified the specific reason to adopt the w state, added an overall control block-diagram, clarified the most difficult issue in 4D problems, presented the control input history, following the reviewer's indications.</p> <p>We address point by point the reviewer's comments below.</p> <p>Authors' response to the reviewer's comment 1: Thanks for your comments. In actual environmental economic issues, the state variables x, y, z, and w represent the total resources consumed, the GDP, the amount of pollution, and the amount of environmental taxes in an economy during a period. Furthermore, the idea of environmental tax reform to shift tax towards profits arisen from the increasingly serious environmental problems, so the w state is adopted. The revised sentences are as follows.</p> <p><i>Following the general stream of constructing hyperchaos, in particular designing a hyperchaotic system from an originally chaotic but non-hyperchaotic system with some simple feedback control techniques purposefully, which is a theoretically very attractive and yet technically challenging work [38]. Moreover, the idea of environmental tax reform to shift tax towards profits arisen from the increasingly serious environmental problems. Therefore, a nonlinear controller is added to the 3D Resource-Economy-Pollution system [39]. Let x, y, z, and w represent the state variables which are linearly independent with each other among the internal variables of the system. In actual environmental economic issues, the state variables x, y, z, and w represent the total resources consumed, the GDP, the amount of pollution, and the amount of environmental taxes in an economy during a period.</i></p> <p>Authors' response to the reviewer's comment 2: Thanks for your comments. The revised manuscript has added an overall control block-diagram in Fig. 4.</p>

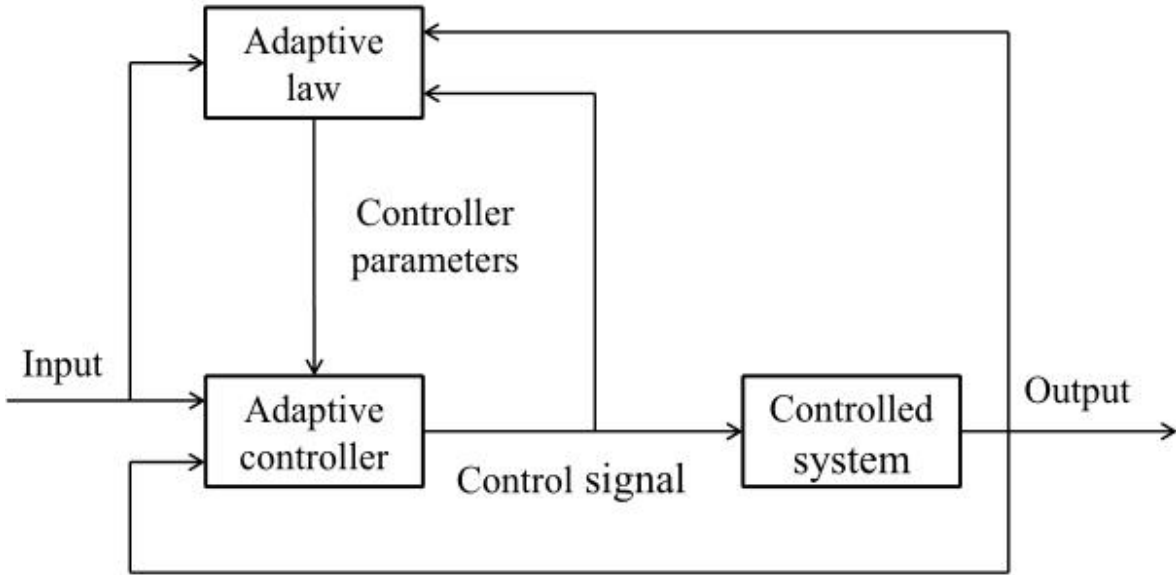


Figure 4: The work flow chart of adaptive control

Authors' response to the reviewer's comment 3: Thanks for your comments. The numerical values given in Eq. (2.1) are obtained through step by step searching. Firstly, we use Routh-Hurwitz criterion to obtain the unstable parameters. The range of chaos parameters is further reduced by dissipative analysis. Thirdly, the chaos parameters are got via point by point searching. Finally, the hyperchaotic parameters, namely the numerical values, are determined in the light of the Lyapunov exponent spectrum of system (1.1). Hyperchaos may appear when there are two positive Lyapunov exponents. Therefore, we select a set of parameters as shown in Eq. (2.1).

We have added the following sentences to explain how to select the numerical values (those sentences highlighted in yellow in the second paragraph in page 4).

The hyperchaotic parameters are obtained through step by step searching. Based on Routh-Hurwitz criterion and dissipative analysis, the range of chaotic parameters is reduced. Furthermore, the range of hyperchaotic parameters is determined in the light of Lyapunov exponent spectrum.

Authors' response to the reviewer's comment 4: Thanks for your comments. The 4D systems have more complex properties compared with 3D systems. Firstly, the existence of hyperchaos needs a fourth dimension. Secondly, the 4D system will experience a broader bifurcation. Lastly, the higher dependence of hyperchaotic systems on initial conditions than 3D chaos system.

We have added a new paragraph to clarify the difference between 3D problem and 4D problem (the new paragraph highlighted in yellow is the second paragraph in page 2). Besides, Fig. 3 shows four 3D phase diagrams from different view. We are sorry that the 3D phase diagram is omitted in section 4 for the length of the paper. The new added paragraph is as follows.

Generally, the 4D systems have more complex properties compared with 3D systems. Firstly, the existence of hyperchaos needs a fourth dimension. So some analyzing tools for 3D system are not valid to 4D system [2]. Moreover, the 4D system will experience a broader bifurcation. The mathematical model with dimensions higher than three is beneficial to model practical problems such as electronic circuits [6], electroencephalograms [7], and chemical systems [8]. Finally, the higher dependence of hyperchaotic systems on initial conditions has practical applications such as information encryption and secure communication than 3D chaos system [10].



Authors' response to the reviewer's comment 5: We are sorry for the misleading of the dimensional unit of time in the x-axis. It is non-dimensional. We have emphasized in the revised manuscript.

Authors' response to the reviewer's comment 6: Thanks for your comments. The control input history of adaptive control (the control input history of adaptive control is shown in Fig. 7 in the revised manuscript) is presented in the revised manuscript. A corresponding explanation is also made. However, the control input history of self-linear feedback control and misaligned feedback control are omitted for the length of the paper.

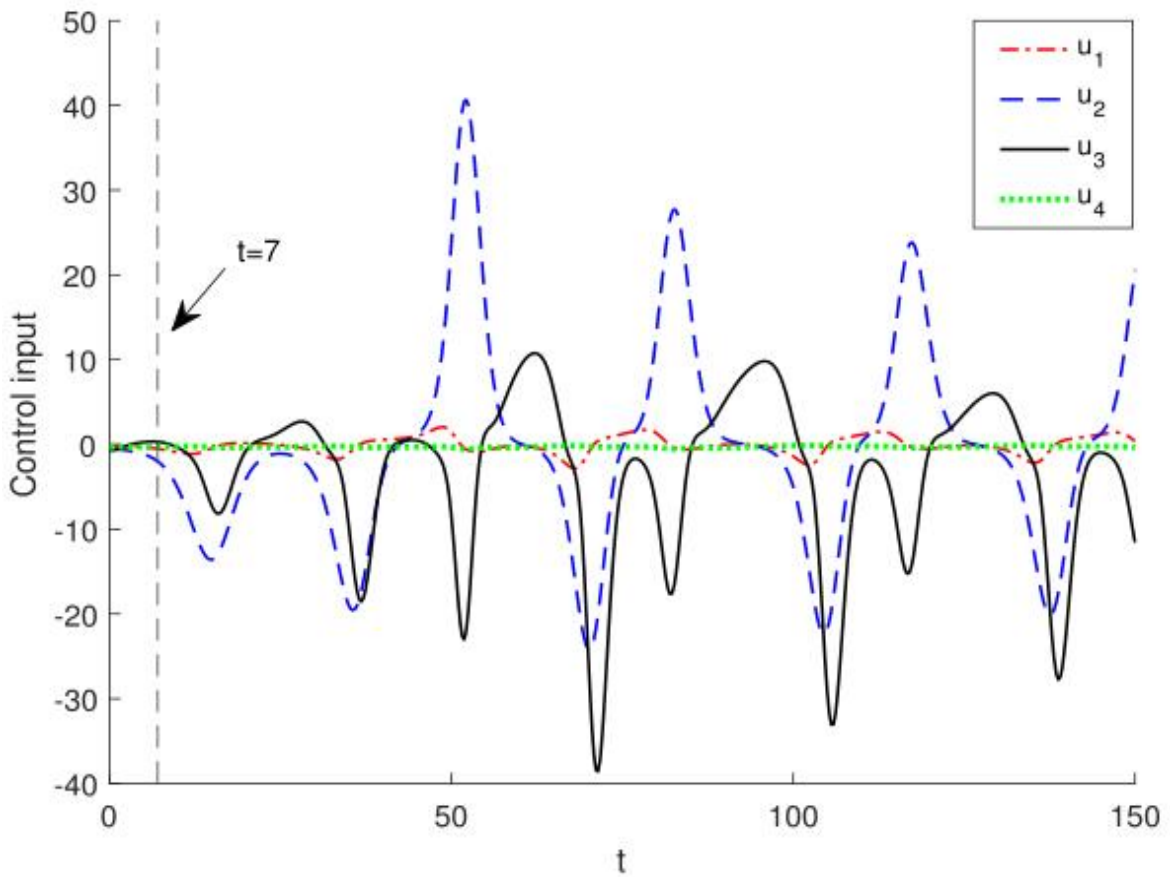


Figure 7: The control input history of adaptive control.

Minor REVISION comments

Major modification are highlighted in yellow following your indication . We also upload a publication-ready Latex source file of the revised submission.

- List of Major Changes:
1. The introduction has been improved with articles dealing with the application of adaptive control in 2D, 3D, and 4D system.
 2. The revised manuscript has contained articles adopt adaptive control in the past three years.



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		3. The novelty of this study has been clarify. 4. The revised manuscript has presented the overall control block-diagram and control input history. 5. The difference between 3D problem and 4D problem has been explained.
<u>Optional/General</u> comments		

PART 2:

	Reviewer's comment	Author's comment <i>(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</i>
Are there ethical issues in this manuscript?	<i>(If yes, Kindly please write down the ethical issues here in details)</i>	There are no ethical issues in this manuscript.