

REVIEW

Nonlinear feedback in a six-dimensional Lorenz model: impact of an additional heating term

B.-W. Shen

I carefully read the paper several times. The principle question is: Why was this paper written, in principle, and what basic problem[s] is [are] discussed here?

The author attempts to discuss a problem of stability of an expanded Lorenz model through the Lyapunov exponent analysis. There are no grammatical errors in the paper, except small ones (e.g., "Model" in capitals in the title, the capture for Figure 7). However there are several problems which should be discussed before the paper is considered for publication.

First, I suppose that the model, which was used for the analysis, should be in the form

$$\frac{dX}{dt} = X - Y + X_1 * X_2 \quad (1)$$

$$\frac{dY}{dt} = X - Y - Y * Z + Y_1 * X_2 + Y_2 * X_1 \quad (2)$$

$$\frac{dZ}{dt} = -Z + X_1 * Y_1 - Z + X * Y \quad (3)$$

$$\frac{dX_1}{dt} = Y_1 - X_1 + X * X_2 \quad (4)$$

$$\frac{dY_1}{dt} = X_1 - Y_1 - X_1 * Z - Y * X_2 + Y_2 * X \quad (5)$$

$$\frac{dZ_1}{dt} = -Z_1 + X_2 * Y_2 \quad (6)$$

$$\frac{dX_2}{dt} = Y_2 - X_2 - X * X_1 \quad (7)$$

$$\frac{dY_2}{dt} = X_2 - Y_2 - X_2 * Z_1 - Y * X_1 - Y_1 * X \quad (8)$$

For simplicity, coefficients in Eqs (1)-(8) have been omitted to understand the structure of this system.

The author used another model. Why? How that model was obtained? It is necessary to explain how that model corresponds to Eqs (1)-(8).

Second, independently from the used model the principle problem for systems like (1)-(8) is not their stability but how different dynamical regimes are realized in such a model. For example, how the regime changes for increasing Ra , where Ra is Rayleigh number. In general, system (1)-(8) was early studied by numerical methods and it has been demonstrated that there are several interesting effects. For example, a 3D attractor does not develop because another attractor with a higher dimensionality exists.

The principle problem is how to use systems like (1)-(8) and of higher dimensionality for the practical analysis. In any case, the dimensionality larger than 6-8 is required to discuss a reality.

My suggestion is that the editor should decide if this paper is suitable for publication at NPG. In my opinion, it needs a major revision before being considered for publication. In its present form, the manuscript does not fit the journal scope because NPG is not a pure mathematical journal.

1. Does the paper contain new and significant results?

Partially.

2. Is the paper of an international standard?

Partially.

3. Is the presentation clear and concise?

Yes

4. Does the paper put the obtained results into context, with relevant references?

Yes

5. Is the length of the paper appropriate?

Yes

6. Is the text fluent and precise?

Yes

7. Are the title and the abstract pertinent and understandable to a wide audience?

Yes

8. Are all figures necessary and of appropriate quality?

Yes