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Author's reply ☆

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In Ref. [1], the author studied the dynamic behaviors of a symmetric gyro with linear-plus-cubic damping mounted on a vibrating base. The system is excited by a harmonic force $\bar{\ell}\,\sin\omega t$. With the definitions

$$x_1 = \theta,\ \ x_2 = \dot{\theta},\ \ f = \frac{Mg\bar{\ell}}{I_1}$$

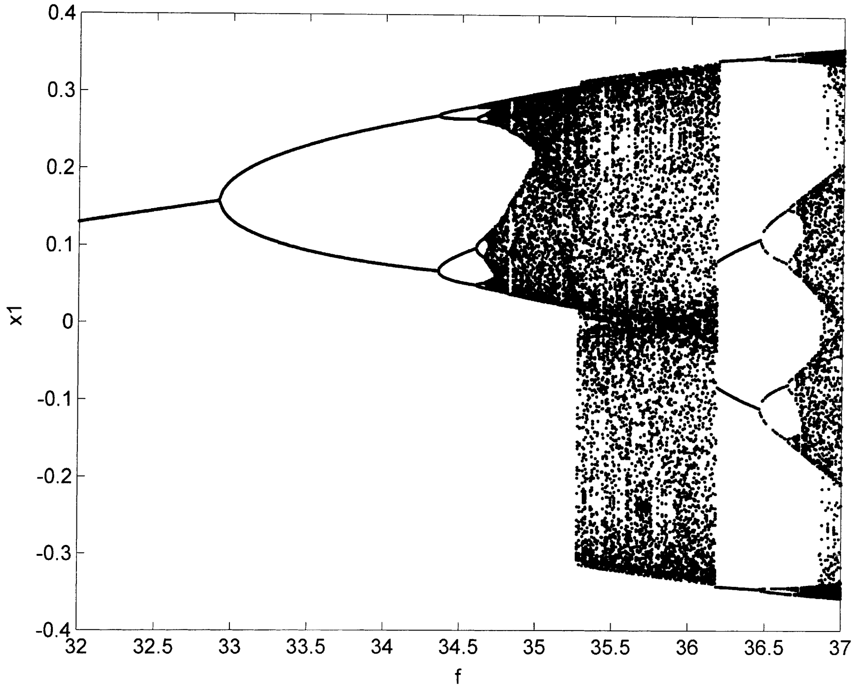

Fig. 1. The bifurcation diagram for x_1 in the range $32.0 \leqslant f \leqslant 37.0$.

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the equation of motion governing the nutation θ of the gyro is given by [1]

$$\begin{cases} \dot{x}_1 = x_2, \\ \dot{x}_2 = -\alpha^2 \dfrac{(1-\cos x_1)^2}{\sin^3 x_1} - c_1 x_2 - c_2 x_2^3 + \beta \sin x_1 + f \sin \omega t \sin x_1. \end{cases} \tag{1}$$

The author used $x_1/4 + x_1^3/12$ to approach $(1-\cos x_1)^2/\sin^3 x_1$ in the numerical simulation. Therefore, the critical values of f at which period doublings occur are different from the results given by Van Dooren [2]. The bifurcation diagram for specific system parameter value set ($\alpha^2 = 100, \beta = 1, c_1 = 0.5, c_2 = 0.05, \omega = 2$) as $f = 32.0-37.0$ is shown in Fig. 1. At the end of the broadest zone of chaotic behavior, a $4T$-solution is also obtained. It is evident that the structure of bifurcation diagram is the same as Fig. 1(a) in Ref. [2].

References

[1] H.-K. Chen, Chaos and chaos synchronization of a symmetric gyro with linear-plus-cubic damping, *Journal of Sound and Vibration* 255 (2000) 719–740.

[2] R. Van Dooren, Comments on "Chaos and chaos synchronization of a symmetric gyro with linear-plus-cubic damping", Journal of Sound and Vibration 268 (3) (2003) 632–634, this issue.