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COMMENTS ON "STOCHASTIC MODEL ON A RATTLING SYSTEM"

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The essential defects of the mathematical model and analytical deductions of reference [1] are shown in this note.

Some problems concerning the stochastic dynamics of a rattling system are discussed in reference [1]. It is interesting to study the non-linear random vibrations. However, some essential defects have been found in reference [1]. The details are as follows.

1. Condition (6)† holds in the process of the motion of the system only when the system is in the contact phase.

After the moment when the system is in the contact phase, the system is in the free-flight phase for a certain interval of time. In this period, equation (5) holds and condition (6) does not hold.

Define

$$I^{*}: \quad \{x_\sigma \in (-(0{\cdot}5 + d), 0{\cdot}5 + d)\},$$

$$I^{**}: \quad \{\xi \in (-(0{\cdot}5 + d + x), (0{\cdot}5 + d) - x\}.$$

Therefore, the contact point of the rattling system jumps in I^* in the process of the motion of the rattling system.

2. The condition for the occurrence of the contact phase of the system in technical practice is deterministic although equation (5) is stochastic. How does a deterministic condition at the contact point in the technical practice get divided into a deterministic condition described by x and a condition described by ξ?

3. On $E[\xi^n\zeta^p]$. According to paper [1], the moment equations are used in the time difference $\Delta\tau_k$ of the two successive impacts.

Corresponding to this $\Delta\tau_k$, there is an interval I_k of the variable ξ in I^{**}. Suppose that every value of the interval $\Delta\tau_k$ only corresponds to one point in the interval I_k and the reverse is correct.

Select the samples A_i^o ($i = 1, 2, \dots, N$) of the solution of equation (5). For A_i, there is a series $\Delta\tau_{ik}$ ($k = 1, 2, \dots, M$) in the process of the motion of the system. Owing to the random variables $\eta(\tau)$ and d, the values $\Delta\tau_{ik}$ ($i = 1, 2, \dots, N$, $k = 1, 2, \dots, M$) are different.

Corresponding to those different time intervals $\Delta\tau_{ik}$ ($i = 1, 2, \dots, N$, $k = 1, 2, \dots, M$), there are different intervals $I_{ik} \in I^{**}$ ($i = 1, 2, \dots, N$, $k = 1, 2, \dots, M$).

$$E_{ik}[\xi^n\zeta^p] = \iint_{I_{ik}} \xi^n\zeta^p R(\xi, \zeta, \tau)\, \mathrm{d}\xi\, \mathrm{d}\zeta. \quad (i = 1, 2, \dots, N, \quad k = 1, 2, \dots, M).$$

† For the meaning of the symbols and the numbers of the equations in this note, refer to reference [1].

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$E_{ik}[\xi^n \zeta^p]$ are different for different i or k. Thus, there is no traditional statistics significance for $E_{ik}[\xi^n \zeta^p]$ obtained in reference [1] (see [2]).

4. In Figures 2 and 5 . According to (3), the intervals I_k ($k = 1, 2, \ldots, M$) vary irregularly, and I_k is the integral limit of the integral $E[v_\sigma]_k^-$. So the definitions of $E[v_\sigma]_k^-$ ($k = 1, 2, \ldots, M$) are different. It is unsuitable for those different $E[v_\sigma]_k^-$ ($k = 1, 2, \ldots, M$) to be plotted on the same vertical co-ordinates in Figures 2 and 5.

REFERENCES

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