Finally, the boundedness of solutions for X and Y in the governing equation of motion of the two dof nonlinear system considered in section 5 of reference [1], is crucial in arriving at equation (17) of reference [1]. The question, then, is: can one guarantee the boundedness of the responses of mdof nonlinear systems even if one can disregard the parametric random excitations? If the answer is affirmative, the next logical question is: how?

REFERENCES

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AUTHORS' REPLY

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The present authors thank Professor To for his interest in our paper [1]. We are delighted to discuss the points raised by him.

In our paper, a quasi-Hamiltonian system is formulated as a Hamiltonian system subject to light dampings and weak stochastic excitations. The Hamiltonian systems considered are holonomic and conservative, and the Hamiltonian $H = H(\mathbf{q}, \mathbf{p})$ is independent of time. Non-conservative Hamiltonian systems are not considered.

For the example in section 5 of our paper [1], the Hamiltonian is

$$H = \tfrac{1}{2}(\dot{X}^2 + \dot{Y}^2) + U(X, Y), \tag{1}$$

since the parametric excitations are treated as the perturbation to the Hamiltonian system rather than as a part of the Hamiltonian system, and the Wong–Zakai correction terms vanish. For an averaged Hamiltonian, the boundaries are often singular just because the Hamiltonian system is subjected to parametric excitations of Gaussian white noises. Here, the effect of parametric excitations on the behavior of boundaries has been considered. Again, the parametric excitations are treated as the perturbation to the Hamiltonian system rather than a part of the Hamiltonian system.

The averaged equation (17) in our paper is derived for quasi-non-integrable-Hamiltonian systems based on a theorem due to Khasminskii [2]. The conditions are that the Hamiltonian systems are conservative and non-integrable, the dampings are light and the stochastic excitations are weak. The boundedness of solutions for X and Y is not a necessary condition for deriving the averaged equation of the two DoF non-linear system (27) in our paper, just as in the standard stochastic averaged method.

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