# On the stability of solutions to the stochastic Hoff equation

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The Hoff equation

$$(\lambda + \Delta)\dot{u} = \alpha u + \beta u^3 \tag{1}$$

is a model of buckling of an I-beam from the equilibrium position. Consider the stochastic analogue of the equation (1). The operators $L$, $M$ and $N$ are defined by formulas

$$L : \chi \to (\lambda + \Delta)\chi, \chi \in \mathbf{U}_{W\mathbf{K}}\mathbf{L}_2,\ M : \chi \to \alpha\Delta\chi,\ N : \eta \to \beta\chi^3,\ \chi \in \mathbf{U}_{\mathbf{K}}\mathbf{L}_2. \tag{2}$$

Then the stochastic analogue of the Hoff equation (1) is represented as an equation

$$L \overset{o}{\chi} = M\chi + N(\chi). \tag{3}$$

This work is a continuation [1], [2] on the study of local stability of a semilinear stochastic equation.

*Theorem 1.* Let $\alpha,\ \beta,\ \lambda \in \mathbb{R}_+$.

(i) If $\lambda \leq -\lambda_1$ then the equation (3) has only a stable invariant manifold that coincides with $\mathbf{M}_{\mathbf{K}}\mathbf{L}_2$;

(ii) If $-\lambda_1 < \lambda$ then there are a finite-dimensional unstable invariant the manifold $\mathbf{M}^+_{\mathbf{K}}\mathbf{L}_2$ and an infinite-dimensional stable invariant manifold $\mathbf{M}^-_{\mathbf{K}}\mathbf{L}_2$ of the equation (3) in the neighborhood of point zero.

## References

[1] K.V. Vasiuchkova, N.A. Manakova, G.A. Sviridyuk. *Degenerate Nonlinear Semigroups of Operators and their Applications.* // Semigroups of Operators – Theory and Applications. SOTA 2018. Springer Proceedings in Mathematics and Statistics. Springer, Cham. 2020. Vol. 325. P. 363–378.

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