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Autowave dynamics of model excitable and oscillatory media in the presence of topological defects

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Investigation of spatiotemporal dynamics of inhomogeneous media demonstrating autowave behavior is one of the actual problems of modern nonlinear science. The topological defects are the particular case of inhomogeneity of nonlinear active media. Autowave phenomena may be observed in the systems of different nature [1], therefore it could be assumed that some peculiarities of interaction between autowaves and defects revealing in simple model systems are universal.

In paper [2] the two-dimensional lattice of model neurons described by piecewise linear maps was observed and the possibility of control of spiral wave movement by inserting some topological defects in the medium was shown. The movement of spiral wave core along the path composed of the point defects was presented as an example. In this case the defect means absence of model element in a given lattice site. In paper [3] the same kind of spiral wave control was shown for the classical model of excitable medium, namely, the two-dimensional lattice of FitzHugh–Nagumo elements with homogenous diffusion connectivity between these elements.

In this work more common case of topological defects formation is observed, namely, insertion of constant or time-dependent potential in some points of model medium. It is shown that presence of the defect near the spiral wave core leads to "capture" of the wave core by this defect. After that the parameters of spiral wave (spatial and temporal period) may be controlled by varying of the defect potential value. The model lattice corresponding both excitable and oscillatory dynamics (depending of control parameters values) is considered. The possibility of application of revealed peculiarities of autowave-defect interaction is also discussed.

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[1] A.Yu. Loskutov and A.S. Mikhailov, "Foundations of Synergetics", Nauka, Moscow (1990), Springer, Berlin (1991).

[2] K.V. Andreev and L.V. Krasichkov, *Izv. Ross. Akad. Nauk, Ser. Fiz.* **67**, 1701 (2003).

[3] K.V. Andreev and L.V. Krasichkov, *Technical Physics Letters* **31**, 545 (2005).