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Generation of spiral waves pinned to obstacles in a simulated excitable system

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The dynamics of pinned spiral waves, whose tips trace the boundary of obstacles, are of interest due to the impact on human health. In heart, such pinned waves cause longer lifetime tachycardia. In this article, we present two methods for generating pinned spiral waves in a simulated excitable system. In method A, an obstacle is set in the system prior to an ignition of a spiral wave. This method may be suitable only for the case of large obstacles since it often fails when used for small obstacles. In Method B, a spiral wave is generated before an obstacle is placed at the spiral tip. With this method, a pinned spiral wave is always obtained, regardless the obstacle size. We demonstrate that after a transient the dynamics of the pinned spiral waves generated by the methods A and B are identical. Pinned spiral waves in both two- and three-dimensional systems are illustrated.

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