Collective dynamics of swarmalators driven by a mobile oscillator

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Astract

Swarmalators, i.e., oscillators with intrinsic frequencies that are able to self-propel to move in space, may undergo collective swarming and meanwhile synchronous dynamics. In this paper, the swarming dynamics of a population of swarmalators driven by an external mobile oscillator is extensively investigated. It is unveiled that, under the action of the external rhythmic and moving driver, swarmalators may adjust their internal organization and perform a wealth of novel spatiotemporal patterns, such as the double-cluster states and the trapping state, depending on the external driving strength and internal interactions. Transitions among these different states are found, and the mechanism of these transitions are revealed. The phase diagram given through exhaustive computations indicates that one may manipulate the formation and switchings of the organized collective states by adjusting the external driving force. The present study is expected to shed light on applications of swarming performance control in natural and artificial groups of active agents.

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