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Two Dimensional State Transition of a Swarming Model YAO-LI CHUANG, Duke University, Physics Department, DANIEL MARTHALER, MARIA D'ORSOGNA, LINCOLN CHAYES, ANDREA BERTOZZI, UCLA — A rotating mill is widely seen in swarming patterns of various species, such as ants, fishes, or daphnia. Levine et al. (2000) proposed an individual based model which produces a pair of co- existing clockwise and counter-clockwise mills on top of each other while a unified rotating mill can be achieved by switching the formula of the self-propulsion to an ensemble average. Without changing its fundamental concepts, we modify the model to include a Rayleigh-type self-driving mechanism, which has a cleaner connection to its continuum limit, i.e., macroscopic description, where analysis can be more efficiently done. By varying parameter values, we find that the modified model goes through a three-stage transition from the co-existing state to the unified state. We also compare the numerical results of the model and of its continuum counterpart.

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