

Abstract Submitted
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Self-organized criticality with synchrony and self-breaking phenomena JONG-HA JEON, PILWON KIM, Ulsan Natl Inst of Sci Tech — Self-organizing and spontaneous breaking are seemingly opposite phenomena, and hardly captured in a single model. We develop a second order Kuramoto model^{1 2} with relative damping(friction) which shows frequency locking together with spontaneous synchrony breaking. As the oscillators are synchronizing in frequency, the relative friction decreases accordingly, eventually making the system marginally stable. In the regime that the interacting force and the damping ratio are of same order, the dynamic behaviors of the oscillators alternate irregularly through the process between synchronization, formation-breaking, and reorganization. Especially when the oscillators are maintaining frequency locking, the systems reaction against a random external perturbation shows a power-law distribution, which is another evidence of self-organized criticality³ inherited in the system

¹F. D orfler and F. Bullo, *On the critical coupling for Kuramoto oscillators* , May. 2011. Available at <https://arxiv.org/pdf/1011.3878> .

²Y.-P. Choi, S.-Y. Ha, and S.-B. Yun, *Complete synchronization of Kuramoto oscillators with finite inertia*, Physica D, **240**, 32-44 (2011)

³Steven H. Strogatz. *Exploring complex networks*, Nature **410**, 268-276 (2001).

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