First-order Synchronization Transition in Locally Coupled Maps

Pradeep Kumar Mohanty\textsuperscript{1,}\textsuperscript{*}

\textsuperscript{1} Phys Complex Sys, Weizmann Institute of Science, Rehovot, 76100. ISRAEL

We study a family of diffusively coupled chaotic maps on periodic d-dimensional square lattices. Even and odd sub-lattices are updated alternately, introducing an effective delay. As the coupling strength is increased, the system undergoes a first order phase transition from a multi-stable to a synchronized phase. Further increase in coupling strength shows de-synchronization where the phase space splits into two ergodic regions. We argue that the de-synchronization transition is discontinuous for piece-wise linear maps, and is continuous for non-linear maps which are differentiable.

\textsuperscript{*}Electronic address: pk.mohanty@weizmann.ac.il