the network elements can be calculated from the autocorrelation of different single nodes. In particular, for unidirectional rings, we find analytically that, by adding an element in the ring, a maximum in the autocorrelation function of the elements vanishes, and an extra maximum appears in the spectrum. We compare the correlation and spectral properties of stochastic linear maps to those of deterministic chaotic dynamical system. Linear maps cannot adapt their output to each other to show identical synchronisation. Nevertheless, simply due to the network structure, they show correlation patterns and spectra that are strikingly similar to those observed in some deterministic chaotic delay-coupled networks.

Adaptive Chaos Control for Robot Control

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Controlling sensori-motor systems for versatile, autonomous robots is a challenging combinatorial problem, because many sensory signals need to be simultaneously coordinated into a broad behavioural spectrum. To rapidly interact with the environment, this control needs to be fast and adaptive. Here we develop adaptive chaos control as a new strategy to generate complex behaviour of an autonomous robot. The control quickly and reversibly adapts to new situations and also enables learning and synaptic long-term storage of behaviourally useful motor responses. Thus, the new form of adaptive chaos control provides a powerful yet simple way to self-organize versatile behaviours in autonomous agents with many degrees of freedom.

[1] Nature Physics **6**, 224 - 230 (2010)

Phase lead synchronization in unidirectionally coupled chaotic systems

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We present the new effect of phase lead synchronization of unidirectionally coupled (drive–response configuration) chaotic oscillators. Here the phases of the coupled systems are locked in such away that the response phase is ahead of the drive phase. This phenomenon appearers when the response system is faster than the drive system. The effect can be used for forecasting the chaotic dynamics of the drive system. We demonstrate this phenomenon for unidirectionally coupled nonidentical chaotic Roessler systems as well as Hindmarsh-Rose neurons. The results of both analytical and numerical investigations are presented.