

## Designing the Dynamics of Networks

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We suggest a new perspective of research towards understanding structure-dynamics relations of complex networks: Can we design a network, e.g. by modifying the features of units or interactions, such that it exhibits a desired dynamics? Here we positively answer this question analytically for networks of spiking neural oscillators[1, 2]. We develop a method of finding the set of all networks that exhibit a given arbitrary periodic spike pattern as an invariant dynamics. The method covers networks of different types of neurons, excitatory and inhibitory couplings, interaction delays that may be heterogeneously distributed, and arbitrary network connectivities.

We illustrate the applicability of the method by designing networks of different given connectivities such that they exhibit the same predefined dynamics. Furthermore, we design networks that simultaneously exhibit a predefined dynamics and minimize the networks' wiring costs, i.e. are structurally optimal.

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- [1] R.-M. Memmesheimer and M. Timme, [http://arXiv.org: q-bio.NC/0601003](http://arXiv.org:q-bio.NC/0601003) (2006).
- [2] R.-M. Memmesheimer and M. Timme, [http://arXiv.org: q-bio.NC/0606041](http://arXiv.org:q-bio.NC/0606041) (2006).