1039-37-170 **Harish S Bhat*** (hbhat@cmc.edu), 850 Columbia Ave., Frazee Building, Claremont, CA 91711.

Stability of periodic orbits in a high-dimensional electrical network.

Consider a ring of N coupled nonlinear oscillators, each of which consists of an inductor and voltage-dependent capacitor. For certain physically reasonably values of the system's parameters, there exist solutions that are periodic in both space and time. In this work, we determine the linear stability of these periodic solutions. The goal of our analysis is to determine the Floquet multipliers of a $2N \times 2N$ non-autonomous linear system of the form $\dot{\mathbf{x}}(t) = (A_0 + A_1(t))\mathbf{x}(t)$. The analysis proceeds in two stages:

1. Using the eigenvectors of A_0, we engineer a transformation that converts the $2N \times 2N$ system into a set of N decoupled 2×2 non-autonomous linear systems. Further transformations are then employed to convert the 2×2 systems into Hill's equation for a certain potential.

2. To analyze each of the N decoupled Hill's equations, we employ perturbative methods and the method of averaging. In this way, we generate approximate formulae for the Floquet multipliers of the original system, together with bounds on the error of our approximations. Finally, numerical methods are used to validate the approximate Floquet multipliers and stability thresholds.

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