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**Identifying Oscillatory Modes Using Harmonically Averaged Equations** JAY QI, JONATHAN TU, CLARENCE ROWLEY, Princeton University, RAJAT MITTAL, Johns Hopkins University — We present a method for analyzing dynamical systems exhibiting oscillatory behavior, using harmonic averaging. This method involves solving modified governing equations to directly obtain oscillatory modes corresponding to certain, specified frequencies. Common spectral analysis techniques post-process time-resolved data from full simulations; our approach instead leverages a priori knowledge of the system to directly compute the oscillatory modes. The method bears some similarity to a previous approach, the nonlinear frequency domain (NLFD) method, and is equivalent under certain conditions. However, because of the ability to choose arbitrary frequencies, harmonic averaging is advantageous in some cases, for instance for quasiperiodic phenomena, or when only a few frequencies are present. We demonstrate the method using a one-dimensional model problem, the Kuramoto-Sivashinsky equation, and show that the harmonic averaging method is able to accurately solve for the oscillatory modes in quasiperiodic systems.

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