PERFORMANCE IMPROVEMENT UNDER PERIODIC FORCING: THE PI CRITERION REVISITED

Costas Kravaris
Dept. of Chemical Engineering
University of Patras
26500 Patras
GREECE

Scott Thompson and Johannes Schwank
Department of Chemical Engineering
The University of Michigan
Ann Arbor, MI 48109-2136
USA

Abstract:
The frequency-dependent pi criterion of Bittanti et al. has been used extensively in applications to predict potential performance improvement under periodic forcing in a nonlinear system. The criterion, however, is local in nature and is limited to periodic forcing functions of small magnitude. The present work develops a method to determine higher-order corrections to the pi criterion, derived from basic results of center manifold theory. The proposed method is based on solving the center manifold PDE via recursive Taylor series. The advantage of the proposed approach is the improvement of the accuracy of the pi criterion in predicting performance under larger amplitudes. The proposed method is applied to a continuous stirred tank reactor, where the yield of the desired product must be maximized.