Experimental bifurcation analysis of an impact oscillator - Tuning a non-invasive control scheme

We investigate a non-invasive, locally stabilizing control scheme necessary for an experimental bifurcation analysis. Our test-rig comprises a harmonically forced impact oscillator with hardening spring nonlinearity controlled by electromagnetic actuators, and serves as a prototype for electromagnetic bearings and other machinery with build-in actuators. We propose a sequence of experiments that allows one to choose optimal control-gains, filter parameters and settings for a continuation method without a priori study of a model. Depending on the algorithm for estimating the Jacobian required by Newton's method we find two almost disjoint sets of suitable control parameters. Control-based continuation succeeds reliably in producing the full bifurcation diagram including both stable and unstable equilibrium states for an appropriately tuned controller.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Applied Mathematics and Computer Science, Dynamical Systems
Contributors: Bureau, E., Schilder, F., Santos, I., Thomsen, J. J., Starke, J.
Pages: 5883–5897
Publication date: 2013
Peer-reviewed: Yes

Publication Information
Journal: Journal of Sound and Vibration
Volume: 332
Issue number: 22
ISSN (Print): 0022-460X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.2 SJR 1.36 SNIP 2.037
Web of Science (2017): Impact factor 2.618
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.09 SJR 1.459 SNIP 2.236
Web of Science (2016): Impact factor 2.593
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.71 SJR 1.31 SNIP 2.15
Web of Science (2015): Impact factor 2.107
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.54 SJR 1.41 SNIP 2.308
Web of Science (2014): Impact factor 1.813
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.61 SJR 1.32 SNIP 2.553
Web of Science (2013): Impact factor 1.857
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.3 SJR 1.441 SNIP 2.939
Web of Science (2012): Impact factor 1.613
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2