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Controlling chaos – Forced van der pol equation

Nonlinear systems are typically linearized to permit linear feedback control design, but in some systems the nonlinearities are so strong their performance is called chaotic, and linear control designs can be rendered ineffective. One famous example is the van der Pol equation of oscillatory circuits. This study investigates the control design for the forced van der Pol equation using simulations of various control designs for iterated initial conditions. The results of the study highlight that even optimal linear, time-invariant control is unable to control the nonlinear van der Pol equation, but idealized nonlinear feedforward control performs quite well after an initial transient effect of the initial conditions. The key novelty is the hint that idealized nonlinear feedforward control is generalizable as a first step, design benchmark.

Biography

Timothy Sands completed his PhD at the Naval Postgraduate School and Postdoctoral studies at Stanford University and Columbia University. Having previously served as a Chief Academic Officer, Dean, and Research Center Director, he is currently the Associate Dean of the Naval Postgraduate School's Graduate School of Engineering and Applied Science. He is an International Scholar Laurette of the Golden Key International Honor Society, a Fellow of the Defense Advanced Research Projects Agency (DARPA), and panelist of the National Science Foundation Graduate Research Fellowship program, and an undergraduate admissions interviewer at Stanford University. He has published prolifically in archival journals, conference proceedings, book chapters, in addition to keynote and invitational presentations; and holds one patent in spacecraft attitude control. He generally publishes non-government funded research under his continued affiliation with Stanford University or Columbia University; while publishing government funded research under his affiliation with the Naval Postgraduate School.

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