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Forcing non-natural outputs via trajectory planning on the forced van der Pol equation

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Nonlinear systems of a strong nature can be considered chaotic. One famous example is the van der Pol equation of oscillatory behavior. This study investigates the control design for the forced van der Pol equation using simulations of various feedforward control designs through the use of trajectory planning. Trajectory designs fed through an idealized feedforward controller can produce outputs trajectories not natural to the non-linear plant. The results of the study highlight that an idealized nonlinear feedforward control performs quite well after an initial transient effect of the initial conditions. Additionally, the study shows that the initial transients can be greatly reduced through a well-developed trajectory plan while simultaneously forcing the output to multiple desired output patterns in the phase plane. Since analytical development is so easy for ideal nonlinear control, this article focuses on numerical demonstrations of trajectory tracking error.

Biography

Matthew A Cooper has completed a M.S. in Electrical Engineering and a M.S. in Aeronautical Engineering from the Air Force Institute of Technology, USA. and his MBA from the University of South Dakota, USA. He is a Deputy Program Manager for the Air Force Research Laboratory – Directed Energy Directorate, a premier research organization. His research focus areas are centered on non-linear feedforwad control, optical beam steering, and disturbance rejection techniques.

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