Abstract

A new method for designing PID Controllers using Bode's ideal transfer function and constrained Particle Swarm Optimization (PSO) is proposed in this paper. Bode's ideal transfer function is introduced using fractional calculus and Carlsson's approximation is used for converting the transfer function from fractional to integer domain. The PID controller is designed by minimizing a hybrid objective function using PSO. Simulation examples confirming the effectiveness of the resulting controller are also discussed in detail and a performance comparison, highlighting the enhanced capability of PSO over other conventional mathematical optimization approaches, is also made in the paper.

References

- D. Shantanu., &quot;Functional fractional calculus for system identification & controls.&quot; Springer, 2008.
Model Reference based Tuning of PID Controller using Bode’s Ideal Transfer Function and Constrained Particle Swarm Optimization

- K. J. Astrom, and T. Hagglund, "PID controller: Theory, design, and tuning."
- H. S. Farhad Farokhi, "A Robust Control-Design Method Using Bode’s Ideal Transfer Function."
- B. M. Vinagre, I. Podlubny, A. Hernandez et al., "Some Approximations Of Fractional Order Operators Used In Control Theory And Applications."
- X. Hui & R. Eberhart, "Solving Constrained Nonlinear Optimization Problem with Particle Swarm Optimization."
- C. S. Thenehalli, "Design Optimization Using Augmented Lagrangian Particle Swarm Optimization;" Faculty of the Graduate School, The University of Texas at Arlington.
- K. E. Parsopoulos & M. N. Vrahatis, "Particle Swarm Optimization Method for Constrained Optimization Problems;"
- X. S. Yang, Introduction to Mathematical Optimization From Linear Programming to
- N. Pillay, "A Particle Swarm Optimization Approach for Tuning Of SISO PID Control Loops"; Masters, Department Of Electronic Engineering, Durban University of Technology, 2008.
- "MATLAB optimization toolbox user's guide", The Mathworks Inc.

Index Terms

Computer Science Control Systems

Keywords

PID Bode's ideal transfer function PSO Active Set optimization Fractional Order Controllers