Original articles

Challenging simulation practice (failure and success) on implicit tracking control of double-integrator system via Zhang-gradient method

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Received 13 September 2014; received in revised form 4 June 2015; accepted 8 July 2015
Available online 17 July 2015

Highlights

- The design processes of the Zhang-gradient (ZG) controllers with explicit and implicit tracking control of the double-integrator (DI) system are presented.
- The examples of static and time-varying systems are investigated to show the effectiveness of ZG controllers for the tracking control problem solving.
- It is shown that different settings of simulation options in ordinary differential equation (ODE) solvers may lead to different simulation results.
- Successful and failed simulation practice helps establish the referential rules for users to choose appropriate settings.

Abstract

Zhang-gradient (ZG) method is a combination of Zhang dynamics (ZD) and gradient dynamics (GD) methods which are two powerful methods for online time-varying problems solving. ZG controllers are designed using the ZG method to solve the tracking control problem of a certain system. In this paper, the design process of the ZG controllers with explicit as well as implicit tracking control of the double-integrator system is presented in detail. In addition, the corresponding computer simulations are conducted with different values of the design parameter $\lambda$ to illustrate the effectiveness of ZG controllers. However, even though the ZG controllers are powerful, there is still a challenge in the simulation practice. Specifically, different settings of simulation options in MATLAB ordinary differential equation (ODE) solvers may lead to different simulation results (e.g., failure and success). For better comparison, the successful and failed simulation results are both presented. The differences in simulation results remind us to pay more attention to MATLAB defaults and options when we conduct such simulations.

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Keywords: Zhang-gradient (ZG) controllers; Double-integrator system; Tracking control; MATLAB ODE solver; Options