

Finite-time stability involves dynamical systems whose trajectories converge to an equilibrium state in finite time. Since finite-time convergence implies nonuniqueness of system solutions in reverse time, such systems possess non-Lipschitzian dynamics. Sufficient conditions for finite-time stability have been developed in the literature using continuous Lyapunov functions. In this technical note, we develop a framework for addressing the problem of optimal nonlinear analysis and feedback control for finite-time stability and finite-time stabilization. Finite-time stability of the closed-loop nonlinear system is guaranteed by means of a Lyapunov function that satisfies a differential inequality involving fractional powers. This Lyapunov function can clearly be seen to be the solution to a partial differential equation that corresponds to a steady-state form of the Hamilton-Jacobi-Bellman equation, and hence, guaranteeing both finite-time stability and optimality.