

INITIAL TIME DIFFERENCE STABILITY IN TERMS OF TWO MEASURES AND A VARIATIONAL COMPARISON RESULT

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Abstract. This paper investigates initial time difference stability in terms of two measures and generalized variation of parameter techniques are unified with Lyapunov-like functions to establish a variational comparison result.

Keywords. initial time difference, Lyapunov-like functions, perturbed differential systems, stability in terms of two measures, variational comparison result.

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1 Introduction

The concept of a Lyapunov function has been employed with great success in a wide variety of investigations to understand qualitative and quantitative properties of dynamic systems for many years. The application of Lyapunov's second method in stability theory [2, 4] has the advantage of not requiring knowledge of solutions. Variation of parameters techniques [1] have wide application in stability analysis as well. Stability theory in terms of two measures [3, 6] unifies and includes a variety of known concepts of stability. In this paper we apply these effective and fruitful techniques with Lyapunov-like functions [4] to obtain stability results for nonlinear differential systems with an initial time difference. We give stability criteria, for a perturbed differential system with respect to an unperturbed differential system that differs both in initial time and initial position [5, 7, 8, 9, 10], in terms of two measures by applying an initial time difference variational comparison result.

In Section 2, we give the definitions necessary for our analysis of initial time difference stability in terms of two measures. In Section 3, we present a variational comparison result for vector Lyapunov-like functions. In Section 4, we apply the comparison result from Section 3 to establish initial time difference stability criteria in terms of two measures. And in Section 5, we have an example to illustrate how the results in Section 4 may be applied.