Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **22 (2015)** 143-158
 http://www.watam.org

AN APPLICATION OF DYNAMIC SYSTEMS ON TIME SCALES WITH INITIAL TIME DIFFERENCE INVOLVING A COMPARISON RESULT AND LYAPUNOV STABILITY

Coşkun Yakar

Department of Mathematics Applied Mathematics

Gebze Technical University, Gebze-Kocaeli, Turkey

Abstract. We investigate the qualitative behavior of a perturbed dynamic systems on time scales that differs in initial position and initial time with respect to the unperturbed dynamic systems on time scales. We compare the classical notion of stability to the notion of initial time difference stability on time scales. We present a comparison result which again gives the null solution a central role in the comparison dynamic systems on time scales when establishing initial time difference stability of the perturbed dynamic systems on time scales with respect to the unperturbed dynamic systems on time scales.

Keywords. A comparison result, Lyapunov stability, dynamic systems, time scales, initial time difference.

AMS (MOS) subject classification: 34C35, 34D10, 34D20, 34D99.

1 Motivation

Mathematical modeling of several important dynamic processes has been rendered via difference equations or differential equations. Difference equations also appear in the study of discretization methods for differential equations. From a modeling point of view, it is perhaps more realistic to model a phenomenon using a dynamic system that incorporates both continuous [4, 7] and discrete times, namely, time as an arbitrary closed set of reals called a time-scale [1,2,3,5]. The recently developed dynamic systems on time scales off a unified approach to continuous and discrete systems [6,9].

Lyapunov's second method is a standard technique used in the study of the qualitative behavior of dynamic systems on time scales along with a comparison result [7, 8,10] that allows the prediction of behavior of a dynamic systems on time scales when the behavior of the null solution of a comparison system is known. However; there has been difficulty with this approach when trying to apply it to unperturbed dynamic systems on time scales and associated perturbed dynamic systems on time scales with an initial time difference[11-16]. The difficulty arises because there is a significant difference