

New explicit global asymptotic stability criteria for higher order difference equations

Hassan A. El-Morshedy *

Department of Mathematics, Damietta Faculty of Science, New Damietta 34517, Egypt

Received 26 May 2006

Available online 29 December 2006

Submitted by K. Gopalsamy

Abstract

New explicit sufficient conditions for the asymptotic stability of the zero solution of higher order difference equations are obtained. These criteria can be applied to autonomous and nonautonomous equations. The celebrated Clark asymptotic stability criterion is improved. Also, applications to models from mathematical biology and macroeconomics are given.

© 2006 Elsevier Inc. All rights reserved.

Keywords: Higher order difference equations; Global asymptotic stability

1. Introduction

The qualitative study of difference equations is a fertile research area and increasingly attracts many mathematicians. This topic draws its importance from the fact that many real life phenomena are modeled using difference equations. Examples from economy, biology, etc. can be found in [1,7,8,12]. It is known that nonlinear difference equations are capable of producing a complicated behavior regardless its order. This can be easily seen from the family

$$x_{n+1} = g_{\mu}(x_n), \quad \mu > 0, \quad n \geq 0.$$

This behavior is ranging, according to the value of μ , from the existence of a bounded number of periodic solutions to chaos. There are similar situations for higher order nonlinear equation

* Present address: Department of Mathematics, Abha Teachers' College, Abha P.O. Box 249, Saudi Arabia.
E-mail address: elmorshedy@yahoo.com.