Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **11 (2004)** 413-430

COMPARISON METHOD AND ROBUST STABILITY OF LARGE-SCALE DYNAMIC SYSTEMS

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To Professor D. D. Siljak on his 70th birthday

Abstract. This paper investigates the robust stability properties of large scale dynamic systems with uncertainty. By utilizing the fundamental matrix solutions of the isolated linear subsystems, we develop a comparison method, which converts the study of complicated large scale systems to that of lower order linear systems. This approach provides a systematic method for the study of robust stability, as well as other stability properties, of large scale systems. Stability criteria are established for large scale dynamic systems described, respectively, by ordinary differential equations, differential and difference equations and neutral type differential and difference equations.

1 Introduction

With the rapid progress in science and technology, many systems of practical interest have become increasingly complex in structure and large in scale. The mathematical models of such systems often contain uncertain parameters and uncertain structures due to the inaccuracies in the modelling process. Consequently, the assessment of robust stability of such systems has become more and more important and difficult. The most popular tool in the study of robust stability of large scale systems is still the Lyapunov's method. People usually employ either a weighted scalar Lyapunov function or a vector Lyapunov function, see [1-7] and references therein. One of the drawbacks of the Lyapunov's method lies in the lack of systematic method of constructing such functions, especially for more complicated systems.

In this paper, we shall consider a different approach. Namely, by utilizing the fundamental matrix solutions of the isolated linear subsystems, we develop a comparison method, which convert the study of a complicated large scale system to that of a lower order linear systems. This approach provides