ABSTRACT

System stability is the most important requirement in the performance of the system. This is true for linear time invariant continuous as well as for discrete systems. The advancement of computer controls of various systems, the linear time invariant discrete system has found applications in many areas.

Stability is an important characteristic in design and analysis of linear time invariant discrete systems as the long range usefulness of a system depends on its stability. For this reason system stability is considered as one of the important criteria while determining system performance as compared to other design parameters. Stability of multi dimensional linear time invariant systems arises in many applications. Foremost among them is the stability of two and multi dimensional digital filters. These filters are used in many fields such as image processing, geo-physics for processing seismic, gravity and magnetic data. Seismic signals are indispensable for oil prospecting and other geological applications. They are also used in processing bio-medical, pictorial and radar data. Other applications arise in obtaining realizability properties of impedance of networks and transmission lines.

Two dimensional recursive discrete filters are used in applications where high selectivity is required. The main problem in the design of recursive filters is to ensure their stability at the beginning stage of the design. Since it is computationally tedious to take care of the stability constraint during the design stage, the stability problem is detached from the design problem. The stability of the designed system is guaranteed by stabilization. Some real time systems are inherently unstable and to stabilize the unstable physical system, a controller can be designed. Thus the stability analysis and stabilization are important.

Among the several forms of stability criterion available, the table form is particularly useful for numerical test of stability, for the root distribution determination and for design purposes. The table form can be easily programmed in a digital computer. Marden (1949) has developed an algorithm which provides a ready means of investigating the stability of the given system from its characteristic polynomial of any order without explicitly determining the roots of the system.

This motivated the research to focus on developing certain new procedures, for the analysis of absolute stability, determination of root distribution, design of sampled-data (1-D) system, formulation of lower order model of given higher order system, stability analysis of multi-dimensional (m-D) system and stabilization of class of two-dimensional (2-D) discrete

systems using Marden (1949) table combining with certain new inferences, using a proposed stability constraint and a novel implementation procedure. The goal of the research is to improve the performance and bring out the capability of tabular form of Marden (1949) stability algorithm. The stabilization of certain two dimensional unstable systems are carried out in one dimensional equivalent form resulting in reduction of the computation. The proposed improvements in Mardens table are applied to various illustrations and the results are provided in the thesis.