CHAPTER I

Introduction

1.1 The Nature of Problems.

In a public address system which uses a microphone and a loudspeaker in the same room, the acoustic coupling between the loudspeaker and the microphone forms a feedback loop. If the feedback signal is in phase with and greater in amplitude than the original signal at one or more frequencies then osoillation will occur and the amplifier is unstable. Consequently the power of the amplifier can not be fully utilized.

Conventional methods of minimizing the feedback are the use of directional microphone and loudspeaker, the proper placement of the microphone or loudspeaker, and the use of expensive acoustic absorbing materials. If the loudspeaker or other components of the system exhibit resonances, the minimizing method may use a passive network or an active network to equalize the response of the system. Although an electrical equalization could be synthesized to equalize the response of the room resonance, the natural resonant frequencies will still change with various factors such as the microphone position, temperature, humidity and number of persons in the room. So all the methods mentioned above have a limited usefulness in solving the problem.

In this thesis a better method will be discussed and this will lead to a new technique to stabilize the system.

1.2 Historical Background

The frequency response between two locations in a room with negligible direct-sound transmission has been studied theoretically and experimentally by M.R. Schroeder(5).He showed that the frequency spac--ing between peak is about 10 Hz and the frequency spacing between peak and adjacent valley is about 5 Hz. A very important result which he found was that highest peak level exceeds the average level by more than 10 dB. This is the cause of positive feedback or instability in a sound system. M.R. Schroeder suggested a possible method to smoothen the response by shifting the signal frequency by an amount equal to the frequency spacing between a peak and its adjacent valley In this manner any excessive gain of a signal of frequency at a response peak is quickly compensated by the low gain of the adjacent valley on its next trip around the feedback loop.

1.3 Outline of Research.

The objective of this research is to investigate a new circuit design, which uses a signal processing technique to improve the stability of the system in the reverberant space. The outline of the work can be summarized as follows:

(a) The stability of audio system with and without frequency shifting is discussed in chapter 2.

(b) The method of audio frequency processing technique to reduce positive feedback in the audio system is presented in chapter 3.

(c) A new circuit design is presented in chapter 4.