FINITE IMPULSE RESPONSE
UTILIZING THE PRINCIPLES OF SUPERPOSITION

by

SCOTT EDWARD CARTER
B.S.E.E., University of Central Florida, 1993

THESIS

Submitted in partial fulfillment of the requirements
for the degree of
Master of Science in Electrical Engineering
College of Engineering
University of Central Florida
Orlando, Florida

Spring Term
1995

ABSTRACT

Window functions have been greatly utilized in the synthesis of finite impulse response (FIR) filters implemented using surface acoustic wave (SAW) devices. The critical parameter in any FIR design is the impulse response length, which must be optimized for the given design specifications in order to reduce the size of each device. To this end, many design algorithms have been introduced such as Remez exchange, linear programming, and least mean squares. A new algorithm has been derived which is efficient and accurate for the design of arbitrary filter specifications requiring less computations than the current algorithms. The FIR design is applicable to general SAW filter design and allows two weighted transducers to be designed in a near optimal method without the need to perform zero splitting or de-convolution.

The thesis first provides the definition of the window functions used for the design process. Then the overview of the design process is discussed using a flowchart of the modeling program for designing an FIR without transducer separation and a sample simulation is presented. Next, the effects of monotonically increasing sidelobes on the transition bandwidth are discussed. This is followed by a discussion of the addition of arbitrary phase to the filter design requirements. Next, the separation of the response into a two transducer design utilizing the two window function series is explained. Finally, the results are discussed and compared with other design techniques.

ACKNOWLEDGMENTS

I would like to thank my advisor Dr. Donald Malocha for his guidance in my studies and my career. I would also like to thank all of my friends and colleagues in the Solid State Devices and Systems Laboratory for their support and advice. A special thanks goes to Rodolfo Chang for the matrix subroutine and Dr. Samuel Richie for the FFT subroutine.

Also, a special thanks goes to Sawtek Incorporated for their continued support and funding of this research.

Finally, I would like to send a special thanks to my family for their constant support and encouragement in all my endeavors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES