University of Victoria | Graduate Studies

Notice of the Final Oral Examination for the Degree of Doctor of Philosophy

of

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"Novel Single-Band and Multi-Band Bandstop Filters for Modern Wireless Communication Systems"

Department of Electrical and Computer Engineering

Friday, April 22, 2016
10:00 A.M.
Engineering and Computer Science Building
Room 467

Supervisory Committee:
Dr. Jens Bornemann, Department of Electrical and Computer Engineering, University of Victoria (Supervisor)
Dr. Poman So, Department of Electrical and Computer Engineering, UVic (Member)
Dr. Yang Shi, Department of Mechanical Engineering, UVic (Outside Member)

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Dr. Tayeb A. Denidni, Centre Energie Matériaux Télécommunications, INRS Universite de Recherche

Chair of Oral Examination:
Dr. Graham Voss, Department of Economics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

The objective of this thesis is to introduce novel procedures and guidelines to design bandstop microwave filters for modern terrestrial and satellite wireless communication systems. Among all available microwave filter technologies, planar structures of microstrip and substrate integrated waveguide (SIW) are chosen, due to ease of fabrication, low profile, weight and manufacturing cost. Particularly, SIW structures are more attractive because they have a better insertion loss, quality factor, and power handling capability in comparison to their microstrip counterparts, and can also be easily integrated into other planar circuitries.

A comprehensive hybrid analytic-optimization method is developed to synthesize any single-band as well as multi-band bandstop coupling matrix. In this method, the location of reection zeros (RZs) and the attenuations in stopbands can be determined in advance.

Several novel single-band, dual-band, and triple-band bandstop filters are designed using regular and ridged SIW resonators, in-line coupled singlet resonators, cross-coupled resonators, and bandstop stubs. The designed filters have fractional bandwidths from 10% to 23%. Moreover, a tunable ridged SIW bandstop resonator and a tunable CPW resonator, etched into the top plate of the SIW transmission line, are introduced. Combining these two resonators, a dual-band SIW filter is designed that permits one of its stopband to be tuned while another stopband is fixed. All introduced filters in this thesis are verified by commercial electromagnetic software, analytic investigations using Matlab codes, and measurements.