University of Victoria | Graduate Studies

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

of

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"Enhancement of Target Detection Using Software Defined Radar (SDR)"

Department of Electrical and Computer Engineering

Monday, November 19, 2018
11:00 A.M.
Engineering and Computer Science Building
Room 660

Supervisory Committee:
Dr. Peter Driessen, Department of Electrical and Computer Engineering, University of Victoria (Co-Supervisor)
Dr. Fayez Gebali, Department of Electrical and Computer Engineering, UVic (Co-Supervisor)
Dr. Stephen Harrison, National Research Council of Canada (Outside Member)

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Dr. Kemal Tepe, Department of Electrical and Computer Engineering, University of Windsor

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Dr. Stephen Ross, Department of English, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Three novel approaches that are based on a recent communication technique called time compression overlap-add(TC-OLA),are introduced into pulse compression(PC) radar systems to improve the radar waveform shaping and enhance radar performance. The first approach lays down a powerful framework for combining the TC-OLA technique into traditional PC radar system. The new TC-OLA-based radar obtained is compared with other radars, namely traditional linear frequency modulation (LFM), and wideband LFM which has the same processing gain under different background situations. The results show the superiority of the proposed radar over the others. The second approach combines a random phase noise signal with a selected radar signal to build a new radar system, SSLFM radar, that enjoys the low-probability of intercept property, and, therefore, has higher immunity against noise jamming techniques compared with other radar systems. The properly recovery of the transmitted signal, however, requires a synchronization system at the receiver side. In this dissertation, we propose three synchronization systems each having different pros and cons. The last approach takes the radar waveform design methodology in a different direction and proposes a novel framework to combine any number of radar signal and transmit them simultaneously. Instead of trying to achieve universality through waveform shaping optimization, we do so via pluralism. As a proof of concept, all the proposed radars have been implemented and tested on software-defined radar (SDR). The theoretical and the experimental results showed the superiority of all proposed radar systems. Since TC-OLA is fundamental to this work, we add a chapter to propose a new technique called *downsample upsample shift add* (DUSA) to address the limitations of the existing implementation of TC-OLA.