

SUMMARY OF Ph.D. DISSERTATION

School Integrated Design Engineering	Student Identification Number	SURNAME, First name FUKUE, Toshihiko
Title Study on precise angular measurement systems of moving targets in radar signal processing		
Abstract <p>A monopulse tracker angular measurement system is usually used in radar to obtain target's direction. When multiple targets exist in the same radar beam and the same range bin, the monopulse tracker is unable to measure the direction angle of each target. Recently, eigenvalue decomposition techniques including MUSIC (MULTiple SInal Classification) have been developed for propagating wave parameter estimation in array signal processing. They are applied to target's direction estimation in radar signal processing. When the signal-to-noise ratio of radar echo is low, the angle estimation performance by MUSIC is decreased.</p> <p>In this research, new angular measurement systems using MUSIC and Doppler filter bank are proposed. The advantage of the proposed measurement systems is demonstrated by some numerical experiments.</p> <p>Chapter 1 is the introduction of this dissertation. The background of this study is described at first, and the main purpose of this study is addressed. Then, the structure of this dissertation is shown.</p> <p>Chapter 2 deals with the basic concept of radar signal processing, array signal processing and time-frequency analysis concerning this study. First, the history of recent radar research is concisely described. Then, some topics such as monopulse tracker relating to this thesis are introduced. Next, the outline concerning the angular estimation by MUSIC and spatial smoothing preprocessing are described. After that, the basic concepts of time-frequency analysis are shown.</p> <p>In Chapter 3, a new angular measurement system using a Doppler filter bank based on discrete Fourier transforms as a preprocessor of MUSIC is proposed to improve the resolution and angular measurement performance. The numerical experiments show that the proposal method can give higher resolution and angular measurement performance in comparison with the MUSIC without Doppler filter bank.</p> <p>In Chapter 4, a new angular measurement system for moving target in the presence of clutter is proposed. In the proposed method, MUSIC is applied to the outputs of a Doppler filter bank consisting of wavelet transform. The comparison between wavelet transform and STFT as a preprocessor of MUSIC is also discussed. Some numerical experiments show that the angular measurement system using wavelet transform can estimate the angle of target precisely, and achieve it by lower computational cost compared with the system using the STFT filter bank.</p> <p>Chapter 5 gives the conclusion to summarize the results of this study.</p>		