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Radar network topology optimization for joint target position and velocity estimation

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Abstract

In this paper, we tackle the problem of selecting the radar node positions to provide an estimate of the target state vector with a prescribed accuracy. The topology optimization problem is formulated as selection of a fixed number of radar node positions from a set of available ones, where the radar observations are modeled by a general non-linear model. We further propose a topology optimization framework for the simultaneous estimation of the multi-modal parameter vector. In particular, the task of joint position and velocity estimation is considered. The feasibility of the proposed approach is demonstrated for several cost functions, namely, the frame potential, as well as the log-determinant and maximum eigenvalue of the error covariance matrix.

Keywords: radar network, topology optimization, greedy optimization, frame potential, log-determinant.

1. Introduction

In recent years the radar sensor application area experiences a booming growth. Radar sensors, which are becoming much smaller and cheaper due to advances in microwave technology, are widely used for different applications that require 24/7 area monitoring, such as ground/air traffic control, environment monitoring (precipitation, temperature, pollution), patient monitoring, to

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