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CHANNEL IDENTIFICATION UNDER DOPPLER AND TIME SHIFTS USING MIXED TRAINING SIGNALS

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This paper is dedicated with affection to Professor Zuhair Nashed.

ABSTRACT. Channel identification in the presence of Doppler is not as well studied as the one free from Doppler due to the difficulty caused from the time-varying characteristics of the channel. In this paper, we present a method to identify channels with both Doppler and time shifts using mixed training signals. The training signals we use consist of two parts, where one part is a constant and the other part is a conventional training signal, such as a pseudo-random signal or a chirp signal. These two parts in a training signal may be separated either in the time domain or in the frequency domain. The constant signal part is used to identify the Doppler shifts and the other part is used to identify the time shifts. We provide a necessary and sufficient condition on the channel identifiability in terms of the time and Doppler shifts when mixed training signals are used. It can be shown that the condition holds almost surely in most cases of interest in practice.

1. Introduction. Doppler and time shifts (or delays or spread) usually occur in wireless mobile communication systems with high speed transmission, which often causes problems of channel impairments. Due to the Doppler shifts of moving vehicles, the channel is usually modeled as a time variant linear system and is not as well studied as a time-invariant linear channel is. There has been a tremendous amount of research on time-invariant linear system identification with both blind

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