An Optimal Linear Receiver and Codec for a Class of Radiotelegraph Signals

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Abstract

This report describes a digital modem for narrowband, direct printing radiotelegraph signals commonly used for data communications in the decametric (3-30 MHz) radio spectrum. The digital modem functions as an ideal linear receiver/codec which replaces older analog modems used with conventional radio transceivers and printing devices. The modem uses advanced filtering and decoding techniques made possible with modern digital signal processing chips operating at speeds of 10 MIPS or higher. The design includes FIR filters and interleaved matched filters at RF, nonlinear estimators and classifiers at baseband, and symbol correlators individually matched to the signalling code alphabet in the decoders. A full set of buffering, transceiver/printer control and parameter adjustment commands is included.

While intended primarily as a design exercise in the application of modern DSP technology to conventional radio systems, this report can be useful, for example, as a tutorial exercise in a laboratory course in computer engineering or digital signal processing. The report includes a detailed description of the algorithms used at the RF, baseband and codec stages of processing, as well as a discussion and comparison with related designs based on older analog technology. It can be used as the basis for a sequence of laboratory experiments, for example, by modifying software modules used for specific purposes.

Keywords: digital signal processing, ideal linear receiver, matched filter decoder, Viterbi algorithm, narrowband direct printing radiotelegraph.

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