

Multicarrier waveforms bring several major advantages over single carrier waveforms in radar systems: frequency diversity, waveform diversity, short time on target and the possibility to optimize the transmitted waveforms, to mention a few. Interesting waveform designs utilizing diversity have been proposed in the literature already. In this paper, we develop a generalized model that can accommodate a wide variety of design options, both existing and novel ones, in an easy and intuitive way. The developed matrix equations for transmitter and receiver allow for implementing different waveforms simply by filling in the elements to corresponding matrices accordingly. Moreover, intuitive agile generation of waveforms in simulation environments and in practice is facilitated. Waveform optimization examples are provided using the derived model. A Mutual Information based criterion is employed to formulate the optimization problems which are solved analytically. Novel multicarrier spread spectrum waveforms are proposed and generated using the derived model. The radar performance of one of these waveforms is investigated through simulations. It is demonstrated that it can outperform well-known existing multicarrier waveforms. It is also shown that such waveform can lower the peak-to-average-power ratio due to the spreading operation, which is a benefit for the front end designs of the transmitter and receiver.