Comparison of UWB Impulse, FMCW, and Noise Radar for Through-wall Bioradiolocation with Finite Difference Time Domain Simulations

Lanbo Liu[1], **Sergey Ivashov**[2], **Timothy Bechtel**[3], **and Lorenzo Capineri**[4]

[1]School of Engineering, University of Connecticut, Storrs, CT 06269-2037, USA
[2]Remote Sensing Laboratory, Bauman Moscow State Technical University, Moscow, Russia
[3]Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, PA, USA
[4]Department of Electronics and Telecommunications, University of Florence, Florence, Italy

Abstract— Using the finite difference time domain (FDTD) method we have conducted bioradiolocation simulation to assess the effectiveness of remote monitoring of the cardiorespiratory parameters of human behind opaque obstacles by radar. The radiation source types under study are ultra-wide band (UWB) impulse, frequency modulated continuous wave (FMCW), and random electromagnetic noises. The impulse radar demands the most sophisticated hardware source modulation but minimal in software for imaging process. In contrast to the impulse radar, the FMCW radar possesses the advantage of much less demand on high sampling rate electronics, thus reduces the cost of high rate A/D converters, and achieves the similar resolution as the impulse radar but with lower cost on hardware. The noise radar approach possesses the major advantages of the FMCW radar, with the addition of low probability of intercept, and the ability of being immune from interference when multiple noise radars operate in the same frequency band in the vicinity.

This paper will present the simulation results for the 3 types of radar detection of human cardiorespiratory parameters and discuss the pros and cons of each of these radar techniques and recommend the approaches for a number of detection scenarios, including the multiple moving human targets within the radar antenna beam.