

Higher Harmonic Spectra of Radio Frequency Biomarker Responses Enable Label-free Biosensing

Tate Fisher

Department of Electrical and Computer Engineering, University of Michigan, Ann Arbor, MI, 48104, USA
tatefish@umich.edu

Dharmakeerthi
Nawarathna

Department of Electrical and Computer Engineering, Old Dominion University, Norfolk, VA, 23529, USA
dnawarat@odu.edu

Abstract—*It is currently difficult to rapidly detect unknown biomarkers. To address this issue, we developed a device for label-free detection using higher harmonic spectra of biomarker responses to low frequency electric fields (<10 kHz).*

Keywords—*Electric fields, label-free detection, Fast Fourier Transform*

I. INTRODUCTION

The current field-deployable biosensors require prior knowledge about the target molecules of interest. For example, detection of nucleic acid molecules (e.g., circulating DNA) requires the sequences of the DNA molecules so the complementary DNA molecules can be

In general, one of the technical deficiencies that prevent the realization of label-free electromagnetic biosensors is the inability to detect the signal (from small quantity of virus cells) produced by the target (e.g., cells, virus, or molecules) analytes from a large background of non-target analytes within the sample. To address this critical limitation, studies have demonstrated that low electric field excitation (<100 MHz) followed by Fast Fourier Transform (FFT) of the sample response called higher harmonic spectra, can be used to identify the unique biological response of the target analytes without interference from background analytes in the sample. In this study, we have further explored this idea and developed a low cost and field-deployable sensor.