Surface Characterization by Raw Radio Frequency Signals

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It has been found that the tissue structure changes due to different diseases, the level of disease, age etc. and these alterations cause observable changes in acoustic scattering properties. Also, frequency dependent back scatter information had been used to analyses tumors and organs. However, these studies were done by analyzing A mode or B mode images taken from array of transducers with wide bandwidth. In this study, an ex-vivo ultrasound detecting system to identify differently rough sand papers, with the use of single transducer and a surface characterization parameter, Full width at Half Maximum (FWHM) has been introduced. Variance of the FWHM values turned out to be 0.4 MHz for the roughest sand paper while 0.1 MHz2 for the least rough. Comparison of variance using F-test statistics, further proved that all three populations have unequal variances. Rough sand paper means that the size of the particles is higher than that of a smooth one. Thus, the reflected bandwidth should be higher than that of a smooth sand paper. Since the reflected band width is high, FWHM should be high. Thus, for a rough sand paper, variance of FWHM values, should be higher than that of a smoother sand paper. However, scattering of soundwaves form these kinds of rough surfaces is quite complicated and further studies should bedone to prove this explanation. Outcome of this study can be extended to quantify or characterize surface roughness of an organ. Thus, severity or the level of a disease can be identified. Further, for this study, raw rf signals from a single element US transducer has been employed for analysis. Analysis technique, FWHM is also very straightforward and simple, and the simplicity of this technique will be advantageous in the extension of this study;or example, to invent a portable device to carry out such diagnosis.

Keywords: Surface characterization, Raw rf signals, Ultra sound, Single transducer, FWHM