



Recommendation for Mr Krzysztof CZARNECKI

Marseille, August 31st, 2012

Dear Colleague,

During his internship (from May to July 2012) at the Laboratory of Mechanics and Acoustics, Marseille, France, Krzysztof Czarnecki has demonstrated a strong interest in Signal Processing tool design. Especially, he was involved in time-frequency analysis where he is currently improving *Concentrated Spectrogram* techniques.

Among the Time-Frequency (TF) methods, it is recognized that *Concentrated Spectrogram* offers the highest resolution. However, as for most of the modulation methods based on phase processing, a severe limitation results from its poor robustness against noise.

During the 3 months in the laboratory, Krzysztof Czarnecki has shown an outstanding involvement in his research work. He investigated the former technique (Double Frequency) we have developed for ultrasonic microbubble characterization and elaborated a comparative benchmark with the various TF (chirplet) transforms he promotes. The latter includes preprocessing (filtering and resynthesis) of the backscattered signal in order to reduce (eliminate) most of the noise while as preserving informative signal which eventually, could be slightly frequency modulated. This results in a 0.25- μm (formerly 1.0- μm) resolution in microbubble diameter estimation and an improvement of the signal to noise ratio by 3-4 dB.

Krzysztof CZARNECKI is very aware of the necessity of developing an international dimension to his education, I fully support his project and am confident that his open-mindedness and enthusiasm will enable his host team to reach concrete objectives.

Yours Sincerely

Serge Mensah
Associate Professor
Medical Ultrasound