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Matrix Vector-Pade Approximations in Medical Imaging DANIEL BESSIS, APS — Thus far, the conventional theoretical framework for data analysis in biomedical imaging including MRS (Magnetic Resonance Spectroscopy) and MRSI (Spectroscopic Imaging) has been the Fast Fourier Transform (FFT). Many of the limitations can be directly related to the reliance upon FFT, which has low resolution, poor signal-to-noise ratio (S/N), supplies only a shape spectrum and requires fitting, which is non-unique, such that the number of metabolites must be guessed in advance. This can lead both to spurious peaks (over-fitting) and true metabolites being undetected (under-fitting). Clearly, the potential of MRSI in oncology has yet to be realized. In order to achieve this goal, one must go beyond technical (hardware) improvements, important as these are. The fundamental realization is that the measurement contains far more information than heretofore appreciated, and conventionally extracted. A key breakthrough can be made by applying recent mathematical advances in signal processing. It has been conclusively demonstrated within in vivo MRS that the fast Pade transform (FPT) can circumvent the above-described limitations of the FFT As a high resolution, non-linear, parametric method, the FPT substantially improves S/N (signal to noise ratio) and fulfils the most stringent requirements for tumor diagnostics. Here, we propose to go one step further than FPT by introducing Matrix Vector-Pade Approximations.

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