On System Design for Precise Embedded Bioimpedance Spectroscopy

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Impedance Spectroscopy is a powerful, versatile method used in medical applications to analyse the complex impedance of cells, tissues and organs over a range of frequencies. It provides precise, non-invasive measurements that reveal hidden properties. To make impedance spectroscopy more accessible, the design of dedicated embedded systems measuring bioimpedance in an accurate manner is essential. Unlike laboratory instruments, embedded impedance spectroscopy systems do not need to be universally applicable. Instead, they must meet the specific measurement and frequency range requirements of the intended application and fulfil the general conditions of impedance spectroscopy including a high signal to noise ratio, linearity, stability and causality. Intelligent system design realizes further important requirements, including efficient excitation signal generation, fast multi-frequency measurement, precise AC signal analysis and robust, automated signal processing for reliable information extraction.