

Multi-electrode bioimpedance spectroscopy using the localized electrical energy concentration method

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Abstract.

Impedance spectrum in a biological sample may provide diagnostic information due to the changes of impedance related to physiological and pathological conditions. The tetrapolar electrode system on biomaterials has commonly used for measuring impedance spectrum to reduce the influence of electrode polarization effect. However, this method was still affected by negative sensitivity regions and it didn't focus on impedance measurement in a local region underneath the electrodes. The proposed BIS method effectively estimates the impedance spectrum in a local region just underneath the probe. The main idea is to use a focused current pattern that produces a localized electrical energy concentrated in the local region underneath the probe. With these focused current patterns, the corresponding voltages are mainly depending on the conductivity distribution in the local region near the probe. Therefore, we may get some linear relation between the local conductivity and the voltage data induced by the focused current to find the local conductivity. In this paper, we describe the localized electrical energy concentration method for bioimpedance spectroscopy using multiple miniature electrodes and evaluate the system with experimental results. Also, it can distinguish the anisotropic property of an object. We will apply this method to an imaging system in order to reconstruct a conductivity distribution in the region of interest (ROI) only.