Identification of Wire Network Topology Using Impedance Spectroscopy
Qinghai Shi, Olfa Kanoun

A new technique is proposed to locate wire faults and identify wire network topology using impedance spectroscopy (IS). The propagation along the cables is analytical, modelled with flexible multi section cascading features utilizing frequency dependent scattering parameters. Therefore, it doesn’t have the common numerical method problems. The transmission line model has the same spectrum as the measured reflection coefficient ($\rho$) of wire under test (WUT) so that same practical effects such as skin and proximity effects, signal loss, dispersion and frequency dependent signal propagation can be exactly incorporated. For determination of model parameters an inverse problem should be resolved and differential evolution (DE) approach is proposed. The novel method allows locating hard (short and open circuit) and soft (frays and junctions) faults and also for characterization of defects in the branches of network. Results are presented to validate and illustrate the performance of this proposed method.

Keywords: Scattering parameters, Impedance Spectroscopy, global optimization technique, wire fault location, network topology.

Modelling the non-stationary behaviour of time-varying bioimpedance
Benjamin Sanchez, Ebrahim Louarroudi, Rik Pintelon, Ramon Bragos

The electrical bioimpedance (EBI) measurement of varying biological systems $Z(\omega,t)$ (e.g. the heart, the lungs, ...) by means of electrical impedance spectroscopy (EIS) remains an open challenge today. Briefly stated, the bioimpedance is assumed to be time-invariant when it is measured with a frequency sweep EIS approach. Hence, time-varying changes are thus ignored or treated as a noise source. In this work, we attempt to model the time-variant effects and obtain a simple (periodically) time-varying ([P]TV) electrical circuit model with ([P]TV) parameters from experimental in vivo EBI data. The aim is then to illustrate that a limited number of harmonic components of the electrical circuit parameters, which corresponds to an integer number of the bio-system periodicity, can be used to have a realistic evolution of the bioimpedance over time as well as in frequency.