Status:	Available
Group Members:	TBD
Sponsors:	Behraad Bahreyni, PhD, PEng, Assistant Professor, Mechatronic Systems Engineering
Supervisor(s):	Behraad Bahreyni, PhD, PEng, Assistant Professor, Mechatronic Systems Engineering

Background:
Measurement of electrical impedance is of great importance in many technical fields, including microsystems and biomedical applications. Normally, a user has an initial, and often simple, guess for the equivalent electrical components of a device under test (DUT). Such a model can be used as a starting point and more components can be added to the system in order to make the model response as close as possible to that of the DUT.

Goal:
We would like to build an electronic test system that will be able to run a series of measurements on a DUT and calculate the equivalent circuit parameters of a model that the user supplies.

The system is controlled by a computer which sets the output signal amplitude and frequency sweep range. It then reads the data from the input port of the instrument. If necessary, the instrument may repeat the test with a set of known input/output impedances to build a system of equations according to the proposed model. Once enough data is collected, it solves the system of equations to extract the parameters of the equivalent system.

Target performance:

- Operating frequency: 10kHz to 10MHz
- Impedance range: 10 to 10M
- Better than 1% accuracy
- Ability to search for points of interest (resonance, etc)

Deliverables:

- Analog electronic circuits, including a precision signal source and amplifier stages;
- Digital electronic circuits to set the test parameters and transfer the data to the computer for post-processing;

- A graphical user interface on the computer that lets the user set the measurement parameters and plots the measured signals;
- Algorithms for fast and accurate calculation of Z, Y, and h parameters of a two port networks;
- Algorithms for fast and accurate calculation of the parameters of equivalent circuits from a library of standard circuit models;
- Options for saving of the raw and processed data;
- Calibration standards and self-calibration algorithms;
- A sample holder with easy to use component connection mechanism;
- Clear documentation of all the work including the software components.

Required skills:

- Analog circuit design
- Digital circuit design with microcontrollers
- Software development for hardware control and signal processing
- Knowledge of MATLAB and LabView
- PCB design and assembly