SIMULATION OF A ENERGY SOURCE BASED ON PV, FC, ACCU BATTERY AND SUPERCAPACITOR

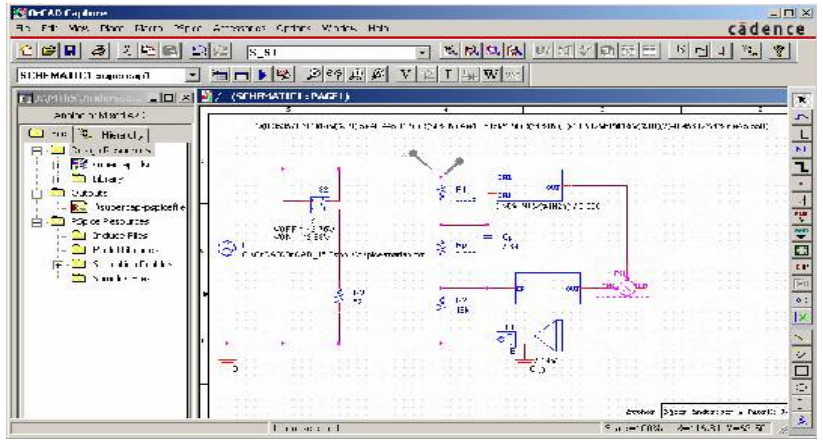
Zoran Stevic, Misa Stevic

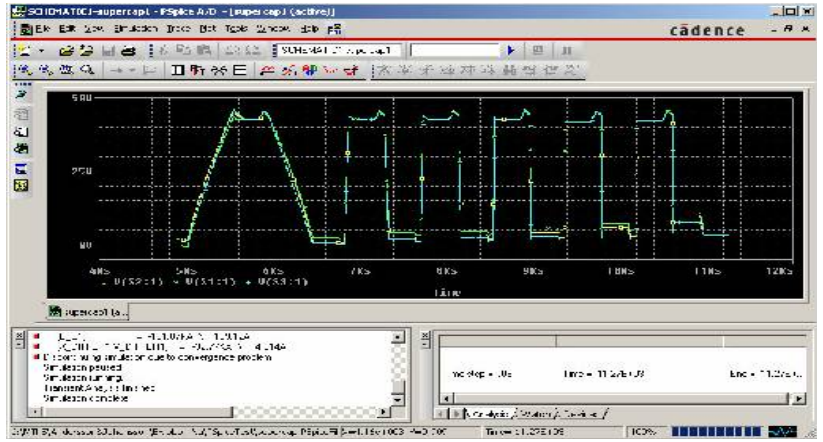
4. Međunarodna konferencija o obnovljivim izvorima električne energije, Beograd, 17. i 18. oktobar 2016
4th International Conference on Renewable Electrical Power Sources, Belgrade, 17th and 18th October, 2016

INTRODUCTION

- To meet increasing demands for fuel efficiency, alternative drivetrains are being developed.
- Electric hybrid vehicles are one such alternative and an important part of them is their energy storage. A similar problem occurs with renewable energy sources (solar and wind power).
- To provide this storage the supercapacitor is an interesting component because of its high power density compared to batteries and Fuel cells. The increasing use of this component provides the base for this problem.
- The analysed program for simulation is OrCAD Capture.

OrCAD User interface





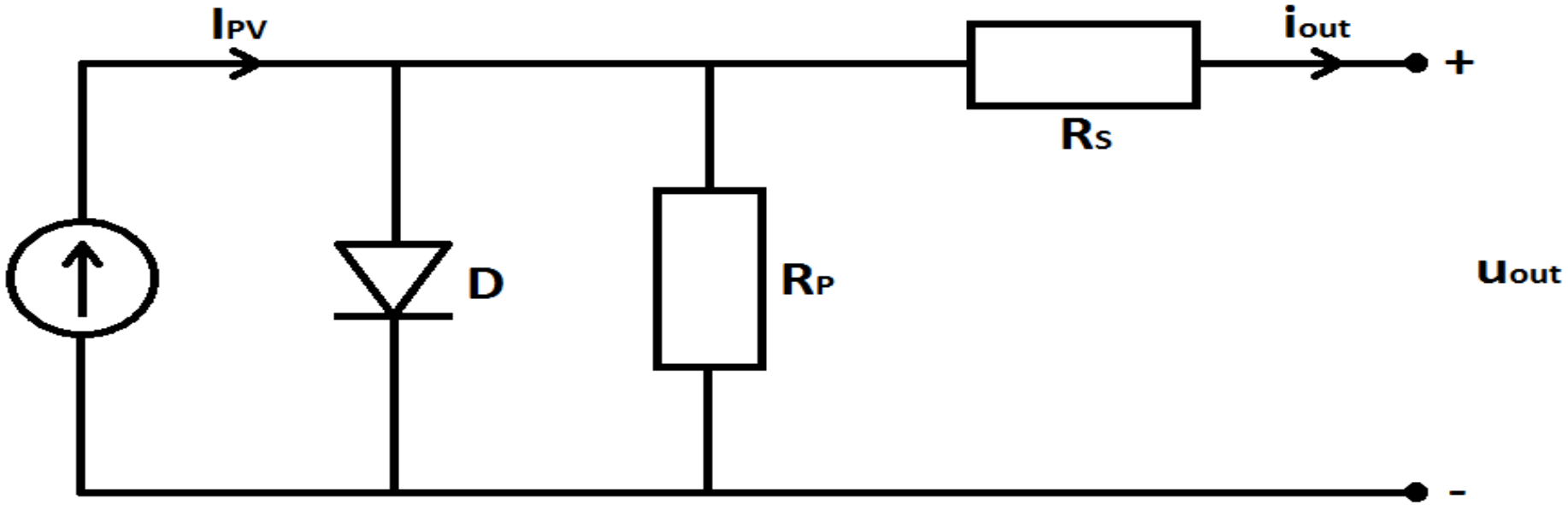
- The programs from Cadence are intended to be used to aid in the design and simulation of electrical circuits.
- The circuit design in Capture is done in a schematic window.
- In the Pspice probe window the results of the simulation can be studied if voltage and current probes have been placed somewhere in the schematic

Different Types of Simulations

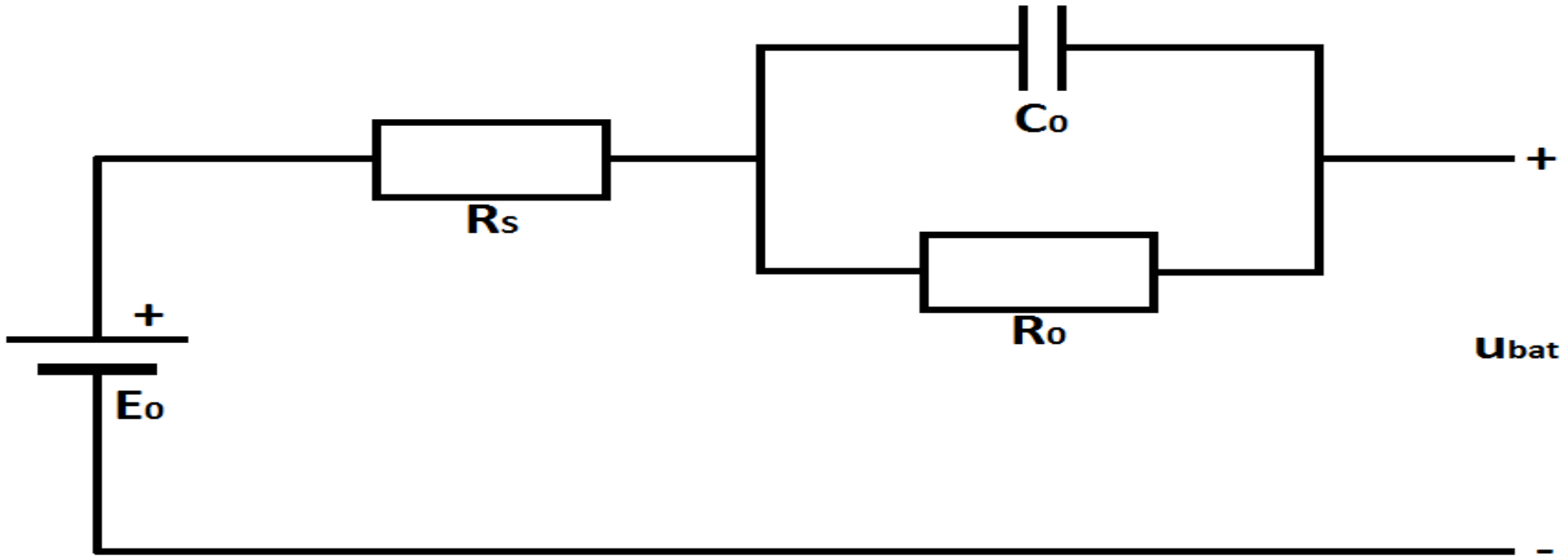
Different types of simulations can be done, each presenting different types of results. In these simulations different parameters, like the supply voltage or resistor value, can be swept to find a good value on a component.

- The available simulation types are:
  - Bias point
  - AC sweep,
  - DC sweep
  - Transient simulation

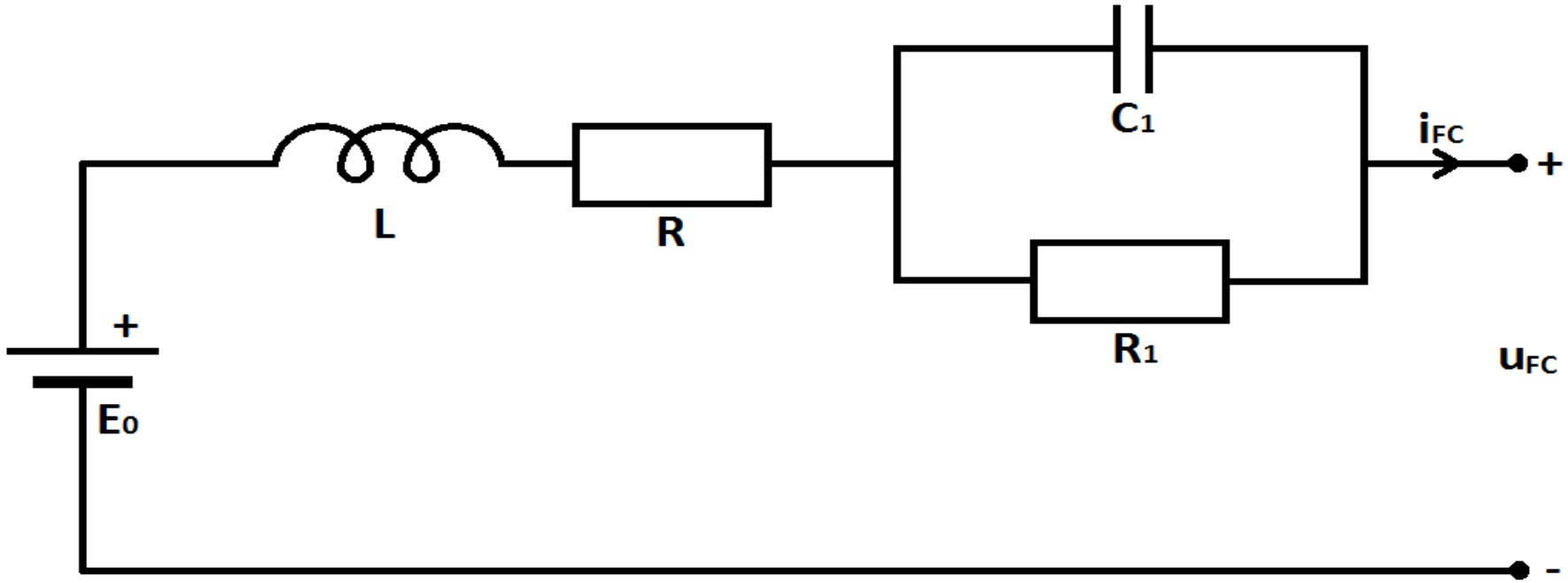
Single diode model of a solar cell



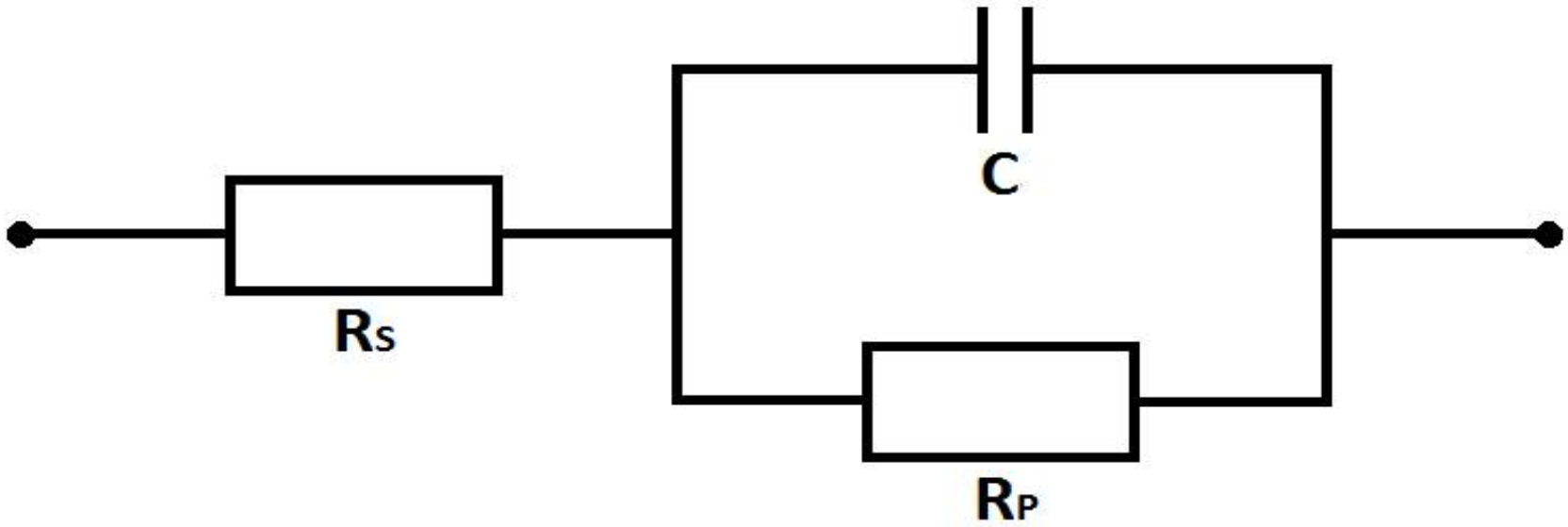
Thevenin Battery Model



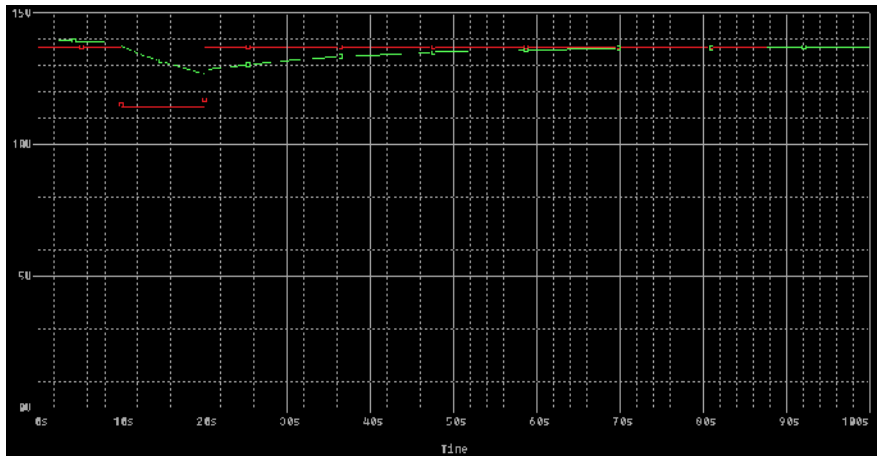
PEM Fuel cell model

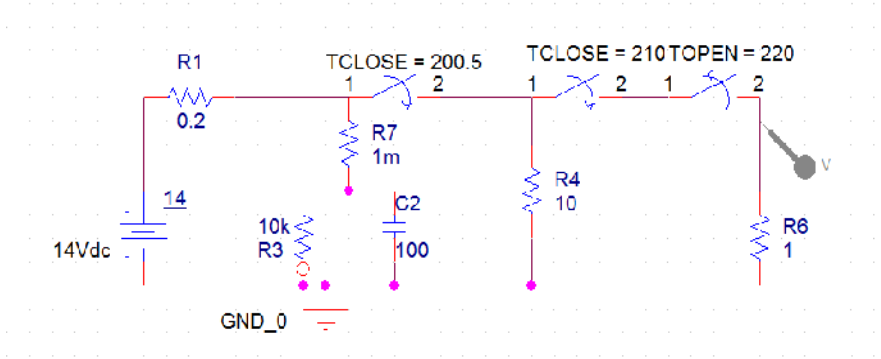


Classical Supercapacitor equivalent Circuit Model



RESULTS





- The results of a simulation of Battery-Supercapacitor system are shown.
- On diagram it is clearly noticeable how the system reacts when large peaks of current are needed. Thanks to the supercapacitors high power density, the output current can be much higher compared to batteries and Fuel cells.

Thanks for watching!