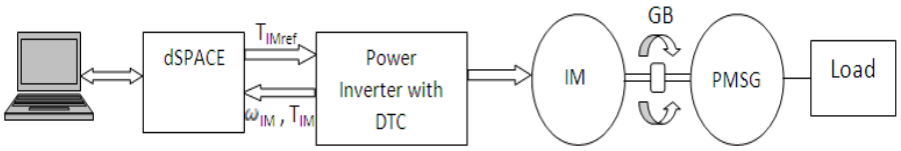
HARDWARE IN THE LOOP WIND/HYDRO TURBINES EMULATORS

Goal of the project

The project was focused on design and testing a "Hardware-in-the-loop" (HIL) wind /hydro turbines emulators, for research and design activities in the field of renewable energies.

Short description of the project

The research and design activities in the field of conversion and control systems for renewable energy applications need to have the possibilities to evaluate the performances of the prototypes in various conditions. In laboratory such tests can't be easy performed because it is difficult to have the entire, real, equipment, and the corresponding input energy parameters.
In such cases, the emulations technologies can be used.
A wind/hydro HIL consists essentially of: a software part which implements the mathematical model of the turbine, and a physical part that provides the similar static and dynamic characteristics as the real studied system.
The HIL structure in this project contains: a dSPACE control board, a voltage source inverter with direct torque control (DTC), a three phase induction machine (IM) with gearbox (GB) – the wind turbine equivalent, and a permanent magnet synchronous generator (PMSG) – the real system generator, with resistive load (Fig. 1).



The emulator control was implemented in Matlab/Simulink and it runs in real time on dSPACE board. The control output signal (torque reference TIMref) is send to the DTC inverter, which returns the real (estimated) IM torque (TIM) and the drive (estimated) rotating speed (ωIM).

Project implemented by

National Institute of Research and Development in Electrochemistry and Condensed Matter

Implementation period

2014

Financed through/by

OXYGEN Cmputers Ltd. Timişoara, România

Main activities

- Wind/hydro turbines mathematical model implementation;
- Design the entire system and the software elements;
- Testing and validation the emulator for various simulated input energy parameters and different control and conversion systems.

Results

- A full scale prototype (Fig. 2), with various software packages.

Applicability and transferability of the results

- The possibility to produce such equipment for research, design and testing companies in the field of renewable energies.
- Consultancy, design and testing activities for developers of power electronics and control equipment for energy conversion systems.

Research Centre

Research Centre for Smart Energy Conversion and Storage

Research Team

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