



Ben-Gurion University of the Negev
Faculty of Engineering Science

Dept. of Electrical and Computer Engineering

Senior Project:
Wind Turbine Emulator

Project number: s-2010-118 / p-2010-067

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Abstract

The modern world that we live in is dependent almost entirely on electrical energy which is growing each year. Along with the growth of electrical consuming has come the understanding that in order to keep our current life style and preventing an environmental damage we need to increase our use in renewable energy sources. This understanding has brought into a shift of the attention at finding new efficient and reliable ways of producing electrical energy from renewable energy sources.

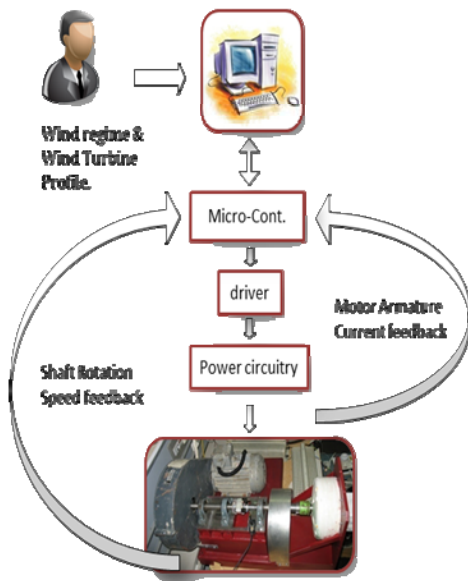
Our project is a system of Wind Turbine Emulator for low power wind turbines. The system will emulate the torque that is being generated by the propeller from the wind turbine. The Emulator will allow lab experimentation that illuminate the need for outdoors experiments in order to test new approaches. Furthermore there is an importance of this system for researches in Ben-Gurion University due to climate conditions (low winds) in our area which do not allow the chance for testing the new approaches. In addition, lab conditions will allow us to reproduce the same "wind" over and over again as we wish for equaling the different approaches.

The system is built of: personal computer that operates as user interface, micro-controller that governs over DC motor (using DC-DC converter of buck topology) to emulate the real Torque of wind Turbine, through gear of 1:3 the system connects to Alternator that acts as SG of a real windmill and as a load for our system.

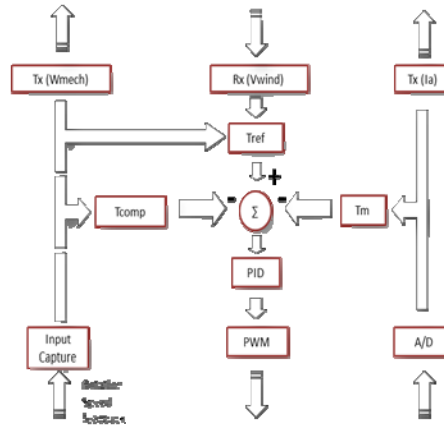
System Specifications:

Parameter	Value	Units
Maximum Output Power	750	W
Nominal Power	390	W
Nominal Torque	7.4	Nm
Sys. Rotation Speed Range	400-1000	Rpm
Nominal Rotation Speed	500	Rpm
Input Voltage	220	Vrms
Motor Type	Brush DC Motor	
Driving Type	PWM	

System in Blocks

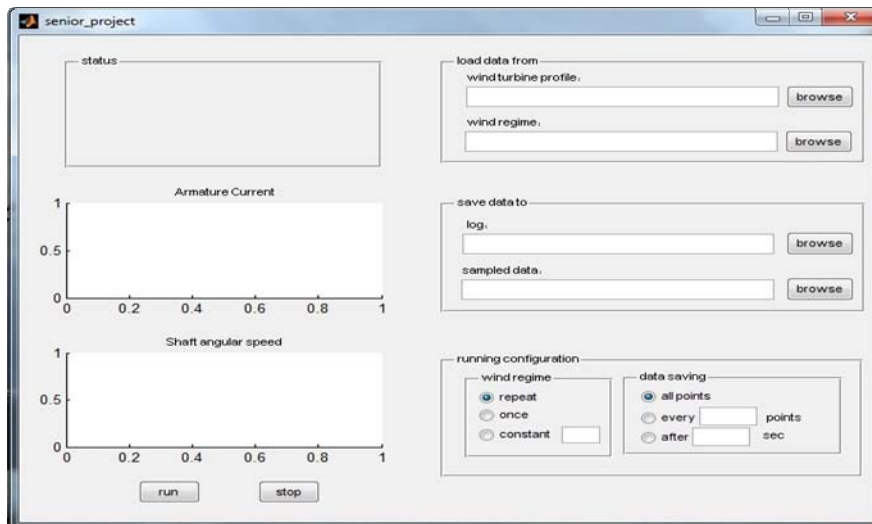


Micro-Controller Logic Blocks



Micro-Controllers logic is the system's heart. This logic has 3 inputs: wind velocity from the computer, generator rotation speed and motor current feedbacks. From these inputs the unit calculates the correct torque that the motor need to emulate. This data is then translated into PWM signal using PI control.

User Interface



To keep an easy use of the system a user interface was created. This user interface, which was developed in matlab environment, can work on personal computer where matlab installed. In this user interface no calculation is being done for controlling the system. Its only acts as a bridge between the user and the micro-controller. It sends wind and turbine profiles to the micro-controller and receives displays and saves experimental results.

