2.2KW DFIG SETUP WITH IGBT BASED   CONVERTER - INVERTER SYSTEM

Doubly fed Induction Generator (DFIG) for variable speed Wind Turbines have more control flexibility and improve system efficiency & Power quality.

We have implemented DFIG using

    i) 1KW Slip ring Induction Motor coupled with 2HP DC Shunt Motor
    ii) Cortex M4 Embedded DSP Controller for DC Motor Control.
    iii) IGBT based Single Quadrant Chopper to Drive DC Motor.
    iv) DSP based Rotor side converter and Grid side Converter
    v) DUAL CORE DELFINO DSP BASED DEVELOPMENT BOARD (or) vi) ZYNQ ULTRASCALE MPSOC based FPGA Dev Board

i. DC Motor Coupled With 1KW Slip Ring Induction Motor

DC Motor as Prime Mover

Power	:	2HP
Armature voltage	:	220V / 8A
Field voltage	:	220V DC / 0.5A
Speed	:	1500 RPM
Make	:	Benn
Double side shaft extension		

Slip Ring Motor (Working as a generator)

Type	:	3phase slip ring inducti
Power	:	1KW
Stator voltage	:	Three phase 415V AC,
Rotor voltage	:	Three phase 230V AC,
Speed	:	1410 RPM
Make	:	Benn

Main Frame

*   Designed to house all the modules
*   Analog Meter/MFM Provided to Display
    *   Output Voltage & Current of Stator (Grid)
    *   Voltage & Current of Wind Emulator
*   Analog voltage meter for voltage of DC motor
*   Analog Ammeter Armature for Armature Current
*   1no of LC filter provided at the Inverter output
*   One step-up transformer provided at the output of inverter
*   2 nos of MCBs provided for over current protection
    of Wind Generator and Grid.
*   Banana connector termination for Wind & Grid
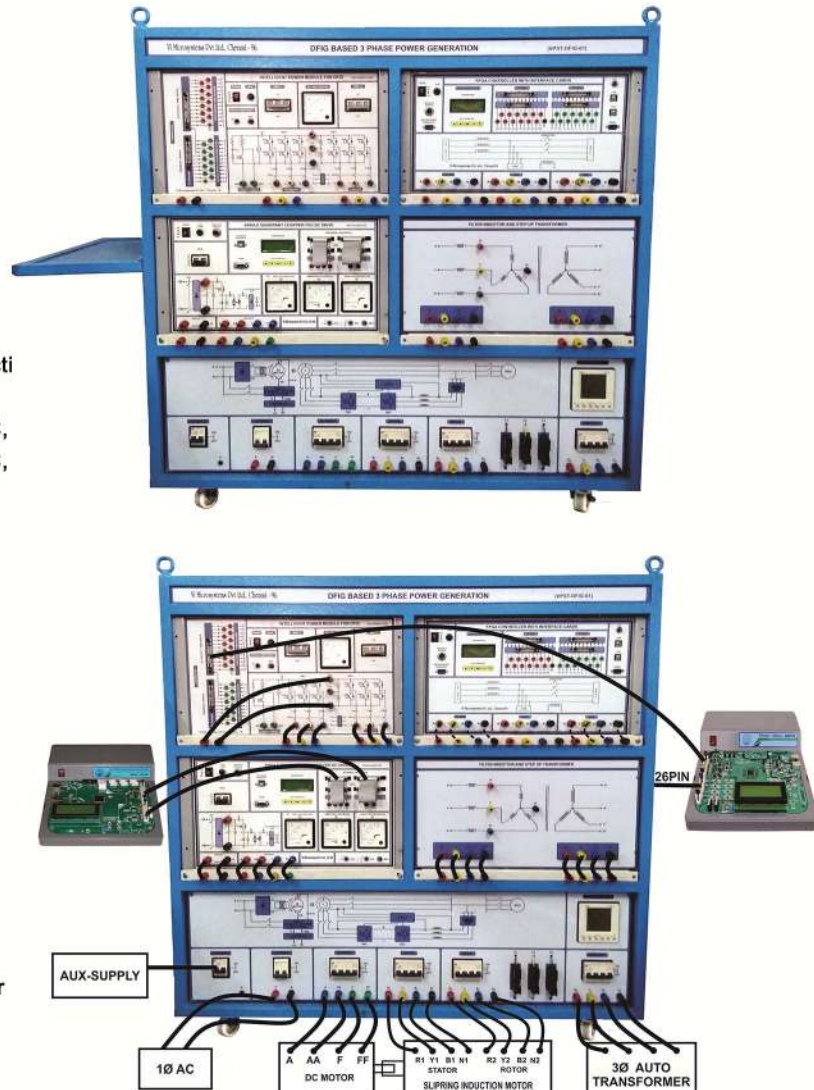
ii. ST Cortex - M4 EmbEdded DSP Controller (VSCM4) for DC Motor Control

*   High performance 32bit ARM Cortex M4 (STM32F407VGT6 Micro controller).
*   Operating upto 168MHz
*   196Kbytes of SRAM
*   1MB On-Chip Flash.
*   8 Nos. of User LEDs & 4 Nos. of push button
*   USB to Serial Interface
*   16x2 LCD interface
*   10/100Mbps Ethernet Interface

* IPM Interface Connector
  * # 16PWM Lines
  * # 8 Capture lines
* ADC Interface Connector
  * # 8 Channel ADC
  * # Input range o to 3.3.V
  * # Sampling rate : 2.4msps
  * # 12 bit resolution
  * # Inputs are buffered and protected
* 2 Channel DAC
* On board Isolated USB to JTAG Programmer

iii) IGBT based Single Quadrant Chopper to Drive DC Motor

* 1200V/50A, Peak, Semikron based IGBT with driver circuit
* 2Nos of IGBT's module provided One driver (inbuilt opto isolator)
* Over Current Protection
* Over Voltage protection
* Short Circuit Protecion
* Fixed Field Supply with field failure protection
* Single Phase Input.
* 2 Pole MCB for input Power
* 3Nos of Analog meters provided for DC motor voltage and current.

iv) DSP based Rotor Side Converter and Grid Side Converter

DFIG are widely used in Wind Turbine with Induction Generators interfaced to the Grid through the Rotor Side Power Converter and Grid Side Power Converter,

IGBT Based Power Module for Rotor Side & Grid Side Converter

Converter Power Module

* 1200V/ 100A Peak, Semikron based IGBT module
* 12Nos of IGBT's provided in 3nos of IGBT module,
* 12Nos driver with inbuilt opto isolator
* Snubber capacitor provided for dv/dt protection for all IGBT module
* Proper heat sink provided for all the IGBTs with cooling fan provision
* Temperature sensor provided for over temperature Protection
* Over current protection and short circuit protection provided for all individual IGBT module
* PWM inputs are brought out on Front Panel, you may connect any controller for interface
* One common +15V Power supply for all the driver circuit, Inbuilt isolated power supply provided.
* Reset circuit provided and terminated to clear the fault
* Filter circuit available for power circuit input.
* 7Nos Current sensor provided for DC link current and Output line current
* 1No Voltage sensor provided for DC link voltage
* One NO of 34 pin connector & 24 pin connector provided in the front panel for PWM input and feedback signals to controller.

v. DUAL CORE DELFINO DSP BASED DEVELOPMENT BOARD Model: (MICRO 28377D)

The Micro-28377D Trainer kit is intended and developed for advanced closed-loop control applications for Power electronics, Smart grid, DFIG, etc.., It is also focused for students to learn the multi-processor architecture and the inter processor communication mechanisms. The inbuilt purpose built peripherals of the processor lead to implementation of many POC for the Research Scholars in the emerging technology.

Features:

- Dual- Core 32-bit Delfino fixed point Processor
- Operating Speed: 200MHz (For each core)
- 32-bit Floating-Point Unit (FPU) which supports floating point operations
- Trigonometric Math Unit (TMU) to speed up the execution of trigonometric operations
- Viterbi, Complex Math, and CRC Unit II (VCU-II) to accelerate the performance of FFT's and communications-based algorithms
- Two CLA real-time control co-processors that run at the same speed as the main CPU's
- Parallel processing capability effectively doubles the computational performance
- 1MB (512KW) of onboard flash memory with error correction code (ECC)
- 204KB (102KW) of SRAM
- 16 Channels (16-bit/12-bit at 1.1 MSPS/3.5 MSPS) Successive Approximation ADCs
- 16 Enhanced PWM outputs, 6 Enhanced Capture Inputs
- 3 (12-bit) Buffered DACs
- 2 SDFM with 8 Input Channels and PWM synchronization
- External memory interface 16/32 bit support
- 192 dedicated PIE vectors
- MCU/DSP balancing code density & execution time
- Single cycle read-modify-write instruction.

ON Board Features:

- 16 Numbers of user LEDs
- 2 Numbers of Limit Switches for user interface
- 4 Numbers of Push-Button Micro Switches
- 1 SPDT Switch for user interface
- 20 × 4 Alphanumeric LCD
- 256MB of SDRAM
- Quadrature Encoder Interface
- Opto-isolated USB Interface
- Opto-isolated USB to Serial Interface
- Opto-isolated on board USB to JTAG Emulator
- PWM Outputs and Capture Inputs are terminated at 34-pin FRC connector
- 16 Channel ADC inputs are terminated at 26-pin FRC connector with buffered and protection
- DAC outputs and sigma Delta ADC inputs are terminated in screw type connector.
- External Emulator facility.
- Compatible with MATLAB SIMULINK
- Software will be provided for
- Wind Emulator
- DFIG Based with Generation