About Us

Head Quartered at Bangalore, India, Entuple Technologies was Founded on 1st January 2010 by professionals with a combined experience of over 80 years in the Electronics Industry. Combined from the words "Enable" and "n-tuple", Entuple is suggestive of enabling multi-dimensional possibilities and growth for all our stakeholders.

The management team with its experience in different sectors such as Aerospace & Defence, Small & Medium Business, Research & Academia has joined together to build a world class team of Next Generation Solution Enablers in system design technologies. Partnering with technology leaders in such areas we also bring together a dynamic eco-system for our customers.

India being one of the emerging markets has been identified as the breeding ground of leading R&D initiatives in multiple domains. Entuple is committed to bridge the ever growing gap in the industry by bringing in expertise to meet technological challenges by introducing cutting edge platforms, tools and solutions.

In the academic sector, Entuple is committed to bridge the growing gap between curriculum and advancements in the industry by providing effective tools, technologies and enablement to the campuses.

Contact Us //

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ENTUPLE TECHNOLOGIES

www.entuple.com

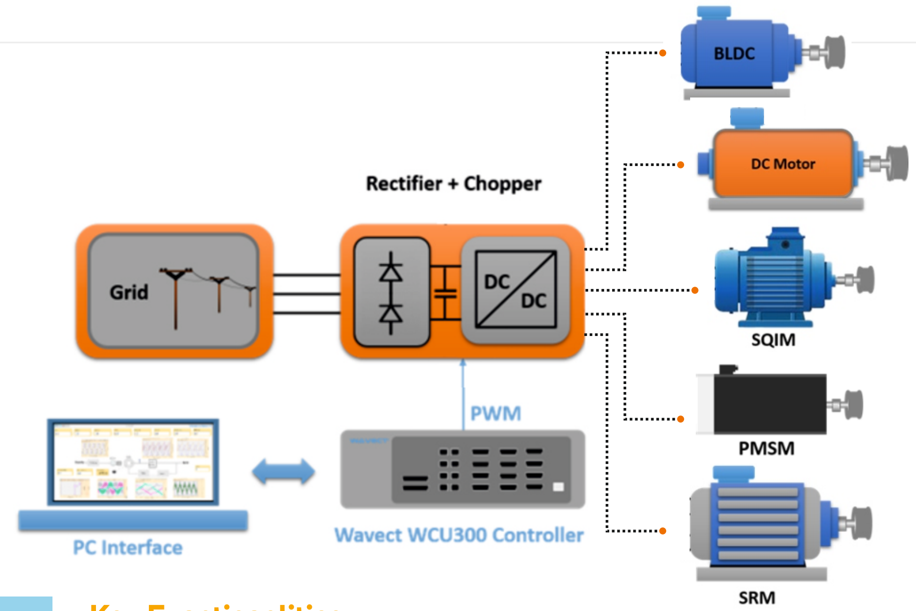
WAVECT

Drives

BLDC Motor Control Drive

Hardware

- WAVECT WCU300
  4VI, 8 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converter for Inverter
- BLDC Motor With Mechanical Loading



System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

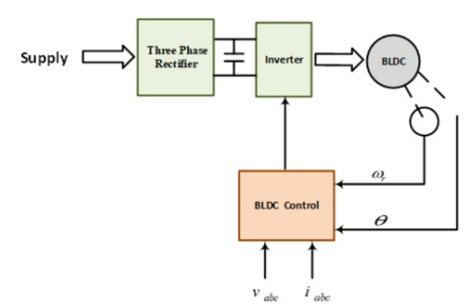
The potential list of Experiments & Research scope as

- Commutation Table based Speed Control of BLDC
- Closed loop Speed Control of BLDC
- Current Controlled Operation of BLDC
- Sensor less Control of BLDC motor
- BLDC Drives with Renewables Integration
- Direct Torque control of BLDC
- Back Emf waveform estimation
- Regenerative braking
- Four quadrant operation of BLDC Drive
- Torque ripple Minimizations

Key Functionalities

BLDC Drive setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Voltage Mode Control.
- Sensor less control.
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.



DC Motor Control Drive

Hardware

- WAVECT WCU300
  4VI, 8 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converter for DC/DC converter
- Separately Excited DC Motor with Mechanical Loading

Key Functionalities

DCM Drive setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Open loop Control.
- Closed loop Control.
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

- Open Loop control of DC Motor
- Closed Loop Armature Voltage control of DC Motor
- Designing Buck converters schemes for DC Motor Drive
- Field Voltage control for Speed control
- Armature current control schemes for DC Motor
- Designing of Filter Inductors for Buck converter

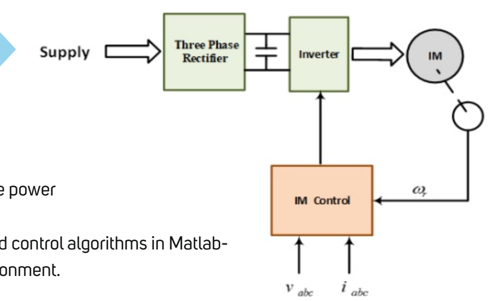
IM Control Drive

Hardware

- WAVECT WCU300
  4VI, 8 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converter for Inverter
- Squirrel Cage Induction Motor

Key Functionalities

IM Drive setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.



- V/F mode of operation.
- Indirect vector control.
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

- Open Loop Scalar Speed Control of IM
- V/f Closed loop Speed Control of IM
- V/f Closed loop Speed Control of IM with Space Vector Modulation
- V/f with boost Closed loop Control for IM
- Field Oriented Control of IM
- Direct Torque control of IM
- Regenerative braking
- Four quadrant operation of IM Drive
- Rotor Flux and Stator flux analysis
- Flux weakening operation

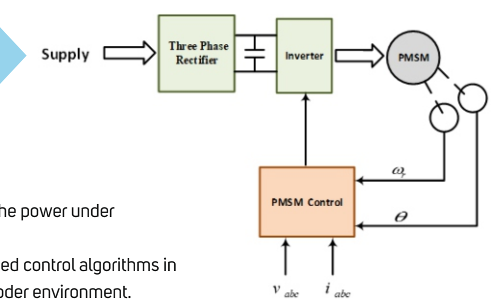
PMSM Motor Control Drive

Hardware

- WAVECT WCU300
  4VI, 8 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converter for Inverter
- PMSM with Mechanical Loading

Key Functionalities

PMSM Drive setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.



- Open loop Control.
- Closed loop Control.
- Field Oriented Control
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

- Commutation Table based Speed Control
- Open Loop Speed Control of PMSM
- Closed loop Speed Control of PMSM
- Field Oriented Control of PMSM
- Direct Torque control of PMSM
- Back emf waveform estimation
- Regenerative braking
- Four quadrant operation of PMSM Drive
- Flux based control and Analysis

SRM Control Drive

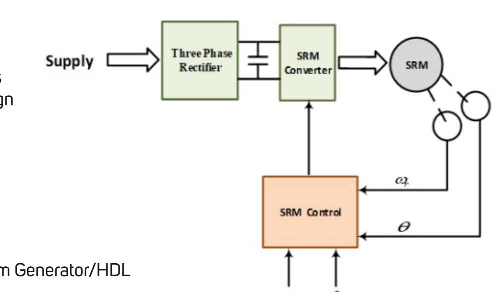
Hardware

- WAVECT WCU300
  4VI, 8 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + 4 Phase IGBT based Power Converter for Inverter
- SRM Motor with Mechanical Loading

Key Functionalities

SRM Drive setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Open loop Control.
- Closed loop Control.
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.



System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

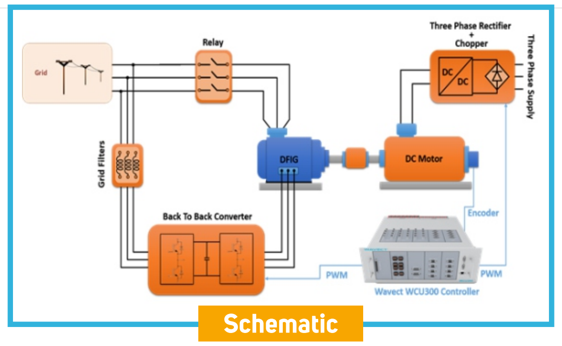
- Switching Table based Open Loop Control of SRM
- Closed Loop Control of SRM
- Current control of SRM Drives
- Torque ripple minimization
- Noise reduction schemes
- Regenerative Braking

Renewables

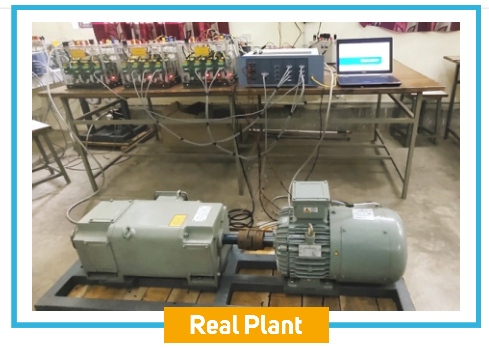
DFIG Based Wind

Hardware

- WAVECT WCU300 12Vl, 24 PWM, 2 En, 8 Relay, 8AIO (optional), 8DIO (optional)
- Doubly Fed Induction Generator
- DC Motor as Wind Emulator
- Encoder
- IGBT based Power Converter for Grid side and rotor side converters, DC- Dc converter for DC Motor Drive and rectifier
- Inductors Filters and Other Accessories



Schematic



Real Plant

Key Functionalities

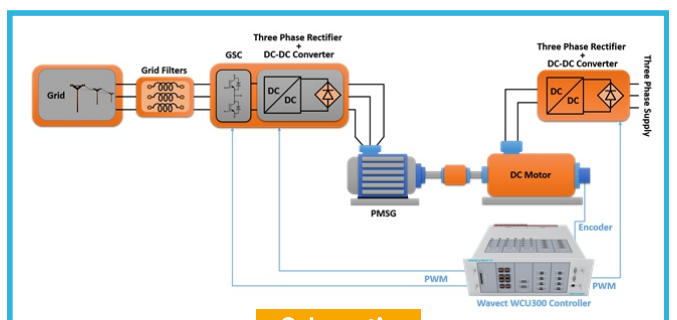
DFIG Wind Energy setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Wind Turbine Emulation
- Dynamic Parameters: wind velocity and pitch angle beta
- MPPT Algorithm for Wind
- Independent Active Power(P) & Reactive Power (Q) control for Grid Side Converter(GSC)
- Rotor Side Converter(RSC) Control for sub- and super-synchronous mode operation
- Synchronization of Stator and Grid Voltages using PLL
- Auto-isolation of emulator, generator and converters under faulty conditions.

PMSG Based Wind

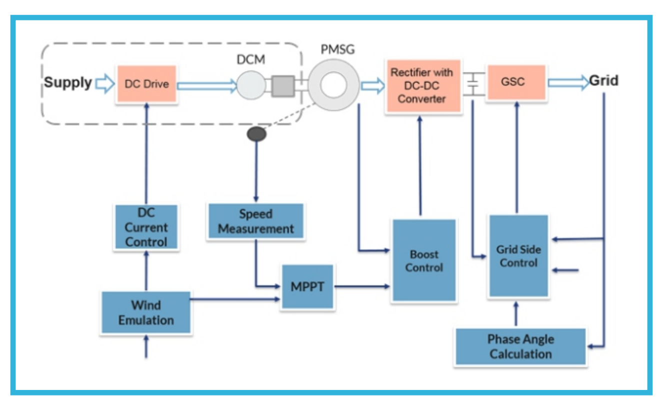
Hardware

- WAVECT WCU300 12Vl, 24 PWM, 2 En, 8 Relay, 8AIO (optional), 8DIO (optional)
- Permanent Magnet Synchronous Generator
- DC Motor as Wind Emulator
- Encoder
- Rectifier + IGBT based Power Converters for Grid side Converter, Boost converter and DC- Dc converter for DC Motor Drive
- Inductors Filters and Other Accessories



Schematic

Real Plant



Control Design

Key Functionalities

PMSG Wind Energy setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Wind Turbine Emulation
- Dynamic Parameters: wind velocity and pitch angle beta
- MPPT Algorithm for Wind
- Independent Active Power(P) & Reactive Power (Q) control for Grid Side Converter(GSC)
- Auto-isolation of emulator, generator and converters under faulty conditions.

Solar PV Energy

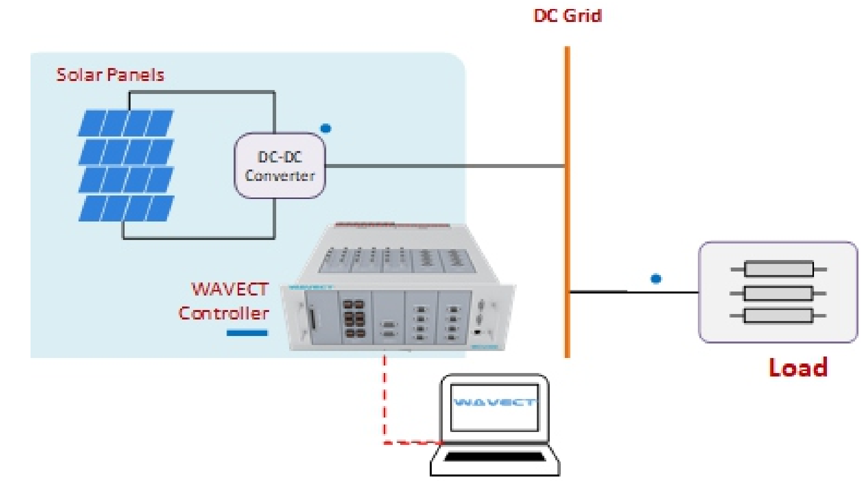
Introduction

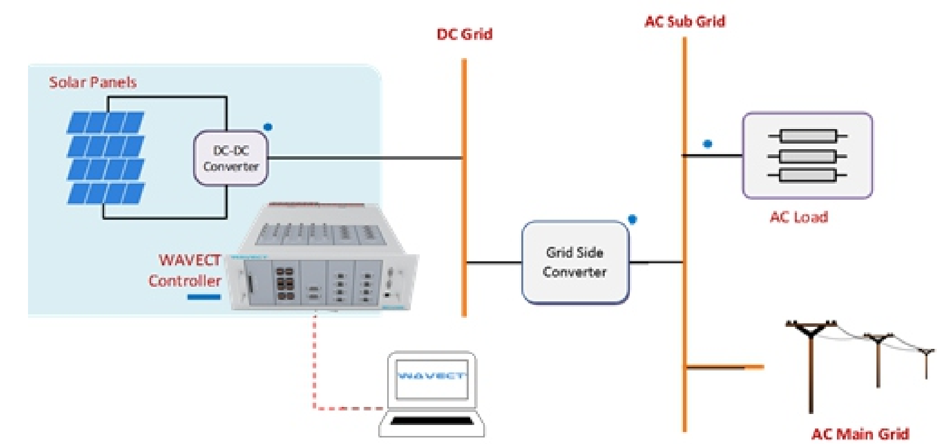
The global energy consumption is rising and an increasing attention is being paid to alternative methods of electricity generation. The very low environmental impact of the renewable energies makes them a very attractive solution for a growing demand. In this trend towards the diversification of the energy market, solar energy is a promising sustainable energy source.

Solar PV systems are generally classified into Grid-Connected, Stand alone and Hybrid Systems.

Stand-Alone PV Systems

These kind of systems are not connected to utility grid, they are self contained and are generally used in remote or rural areas



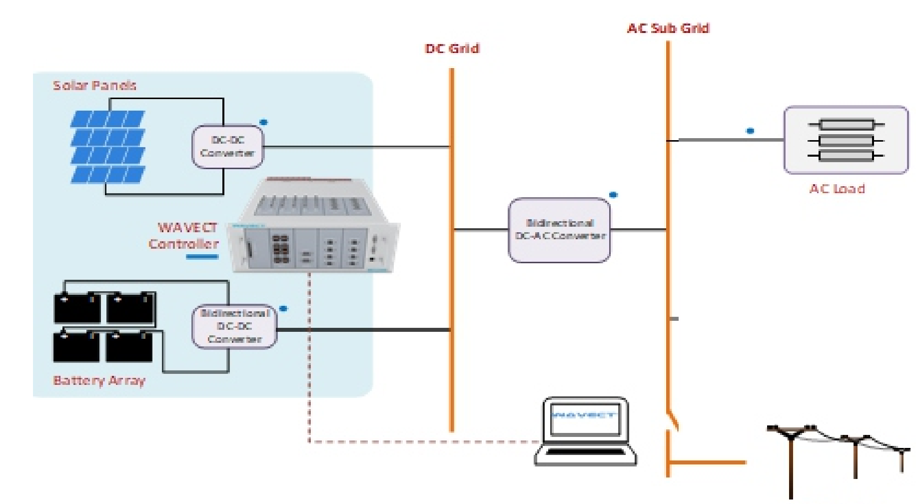


Grid Connected PV System

These type of systems are directly connected to grid via DC-AC Inverter. They are less expensive and no storage is required. In case of excess solar energy, power can be fed to grid directly and during poor weather power is supplied from AC mains and the converters can used to meet reactive power demand of the grid.

Hybrid PV systems

Hybrid system is the combination of above two systems, it can work as a grid connected system or as a standalone system with the help of batteries.

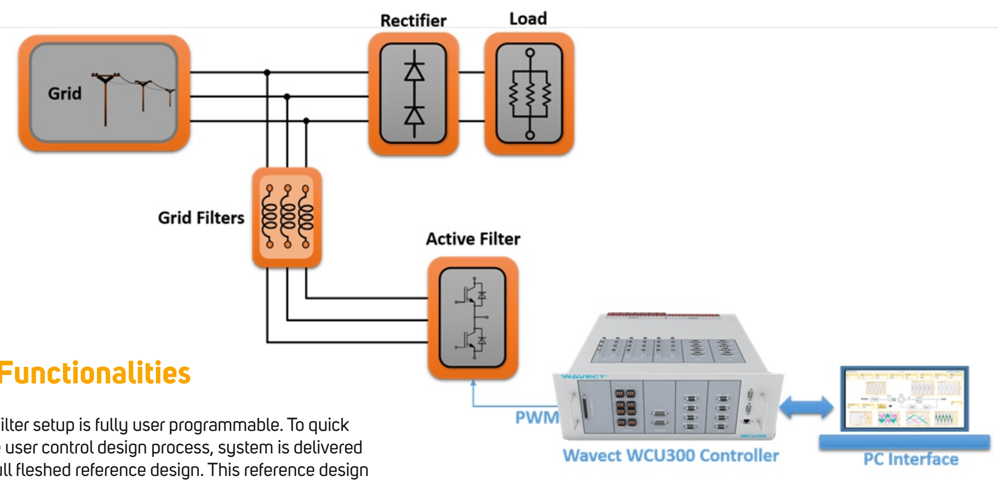


Power Quality

Active Filter

Hardware

- WAVECT WCU300
  8VI, 16 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converters for Active Filter
- Rectifier
- DC Load
- Inductors Filters and Other Accessories



Key Functionalities

Active Filter setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Harmonics Compensation
- Reactive Power Compensation
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular , therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

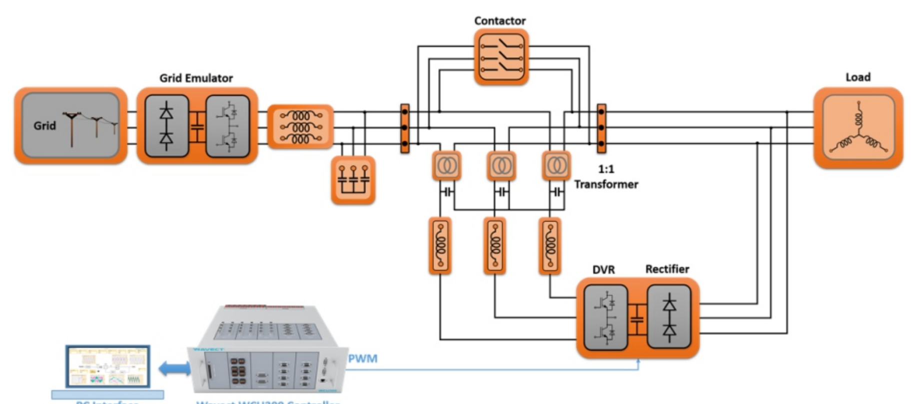
The potential list of Experiments & Research scope as

- Possible fault occurrences.
- Statcom control development.
- Unified Power Quality Conditioner control development
- Controllable DC load development.
- Development of different inverter control techniques.

DVR

Hardware

- WAVECT WCU300
  12VI, 24 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converters for DVR and Inverter
- AC Load
- Transformer
- Inductors Filters and Other Accessories



Key Functionalities

DVR setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Sag and Swell Compensation
- Provision to emulate different types of faults to DVR
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular , therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

- Possible fault occurrences.
- DVR control development.
- Unified Power Quality Conditioner control development.
- Different types of fault emulation development.
- Development of different inverter control techniques.

Grid Emulator

Key Functionalities

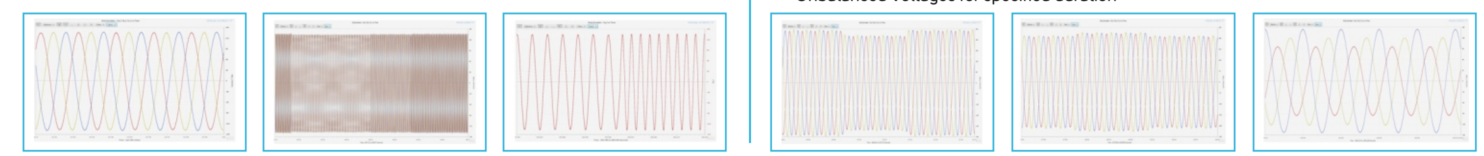
Grid Emulator setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

It can generate different types of grids:

- Three phase power grid from 0 to 440Vac
- Frequency 10 - 60 Hz
- Single phase and two phases voltages for specified duration

Faults that can be generated:

- Voltage Sag between 60 % – 90 % for specified duration
- Voltage Swell between 110 % – 120 % for specified duration
- Under Voltage 60 % – 90 %
- Over Voltage 110 % – 120 %
- Unbalanced Voltages for specified duration



Three phase 440 V AC | Three phase frequency change | Single phase frequency change | 80 % Voltage Sag | 110 % Voltage Swell | Unbalanced Voltages

Hardware

- WAVECT WCU300
  12VI, 24 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converters for Front End Converter and Inverter
- Inductors Filters and Other Accessories

System Potential Scope

The Proposed Configuration is quite open scalable and modular , therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

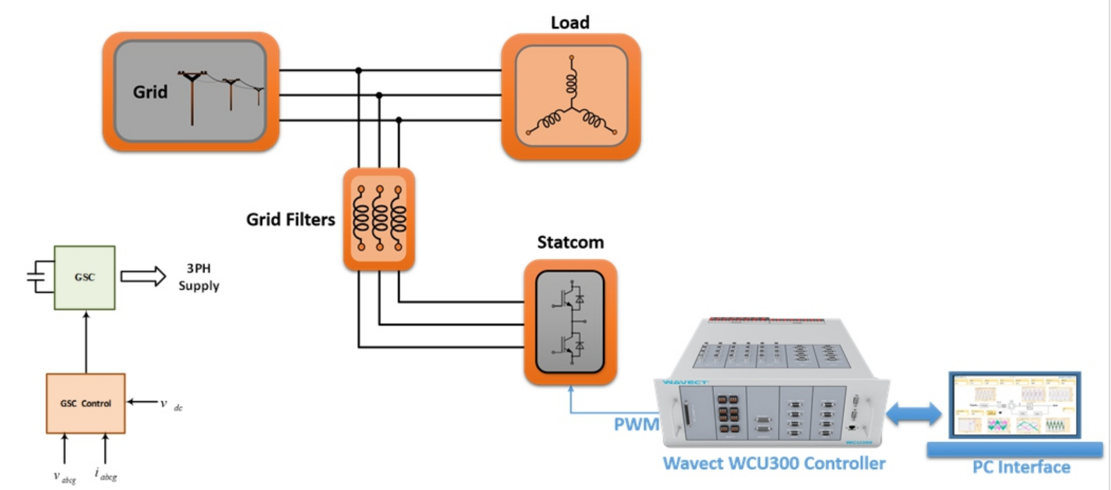
The potential list of Experiments & Research scope as

- Possible fault occurrences.
- Effect of possible faults at different systems.
- Effect of different faults at different loads.
- Emulation of new faults such as flicker , harmonics etc.
- Inverter control testing for different operating conditions.
- Development of different inverter control techniques.

Statcom

Hardware

- WAVECT WCU300
  8VI, 16 PWM, 2 En, 8 Relay,
  8AIO (optional), 8DIO (optional)
- Rectifier + IGBT based Power Converters for Active Filter
- AC Load
- Inductors Filters and Other Accessories



Control Model

Key Functionalities

Statcom is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Reactive Power Compensation
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

System Potential Scope

The Proposed Configuration is quite open scalable and modular , therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

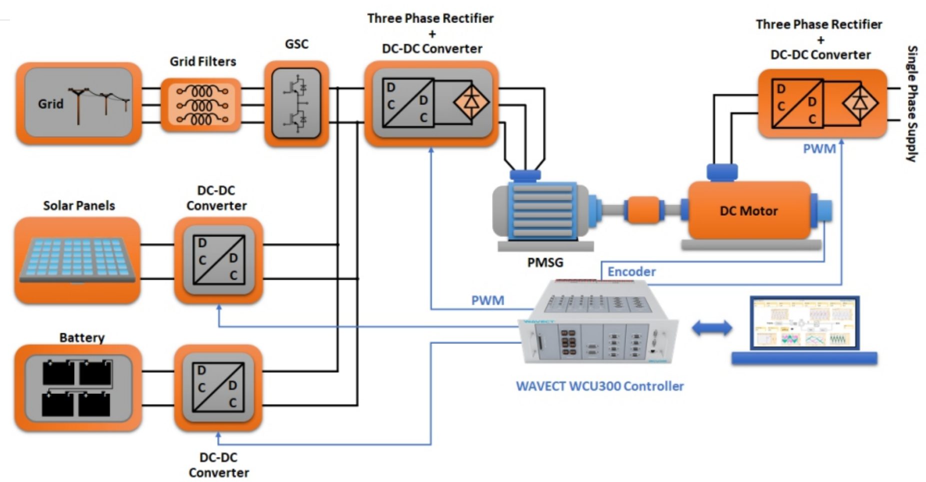
The potential list of Experiments & Research scope as

- Possible fault occurrences.
- Active Filter control development.
- Unified Power Quality Conditioner control development
- Controllable AC load development.
- Development of different inverter control techniques.

Micro Grid Details

Hardware

- WAVECT WCU300 / WCU300 HD 16VI, 40 PWM, 2 En, 8 Relay, BAIO (optional), 8 DIO (optional)
- Rectifier + IGBT based Power Converter for GSC and DC-DC converters
- PMSG with Wind Emulator Setup 2.2 KW o/p
- Solar PV Panel
- Lead Acid Battery
- Inductors Filters and Other Accessories



Key Functionalities

Microgrid setup is fully user programmable. To quick start the user control design process, system is delivered with a full fleshed reference design. This reference design shows the complete operation of the setup. Its control design key functions are as follows.

- Operation of Grid Side converter
- Integration of Power source on to live Grid
- Grid PLL synchronization
- Modeling of Grid Side Filters
- Study and Modeling of MPPT algorithms for Renewable energy setup
- Auto-isolation of converters from the power under different faulty conditions.
- Provision for developing user defined control algorithms in Matlab-System Generator/HDL Coder environment.

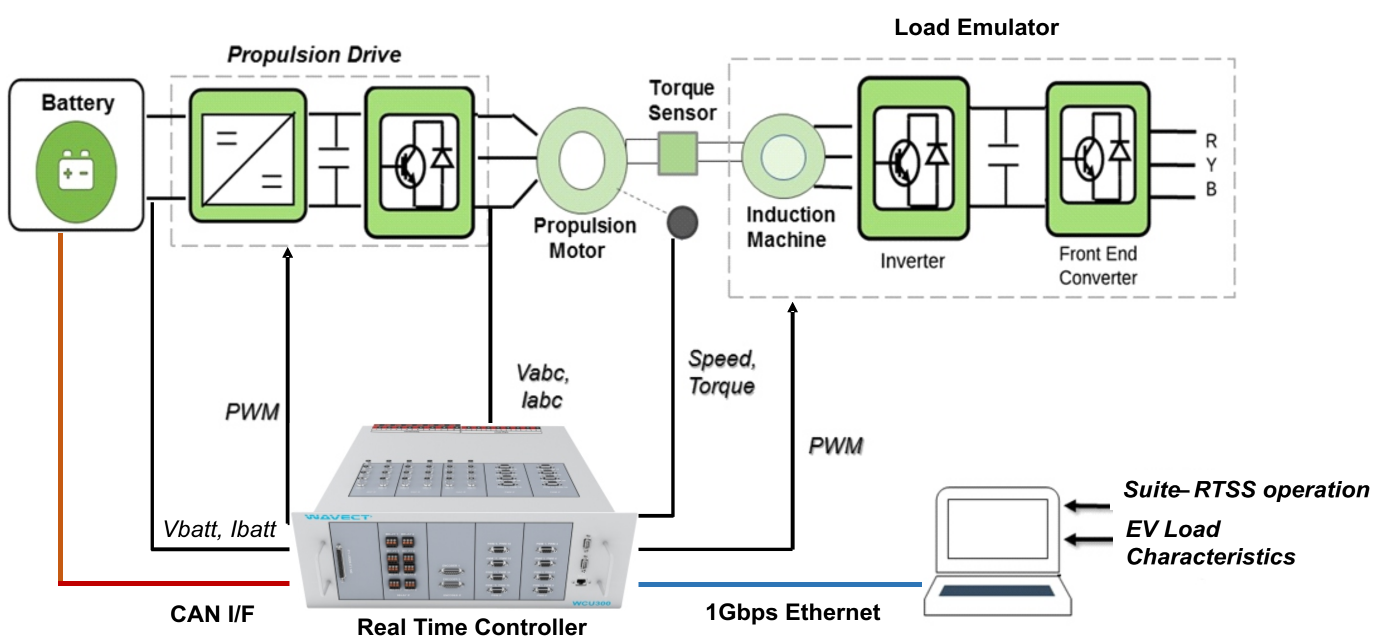
System Potential Scope

The Proposed Configuration is quite open scalable and modular, therefore there are multi-dimensional provisions to deploy the entire configuration or the individual components.

The potential list of Experiments & Research scope as

- Reactive Power control on to the Live Grid and for local reactive power compensation
- THD measurement and Analysis
- Load demand management
- Islanded operation Schemes and Islanding Detection
- Distributed energy source management
- Microgrid protection and control
- Microgrid Architecture Modeling for Control operations

EV-Research Bed



EV Controller – Major Components

Propulsion Motor
Specially designed for demanding EV operation 3KW, 72V, 1500 RPM

Li-Ion Battery Pack with BMS
7.3Kwh, 100Ah, 73.6V

Load Emulator
Programmable Load conditions
Induction Motor – 3KW, 415V, 1500RPM
Torque Sensor – 20Nm
Two IGBT Power Converters

Propulsion Drive
Supports bi-directional power flow (B2M, M2B)
25KVA IGBT Converters

WCU300 Real Time Controller
Advanced Processing, Voltage/Current Sensors, PWMs, Encoders, Communication

Model Based Development
Powerful, Ease to use
Auto Code generation
Suite – Real Time Signals Software

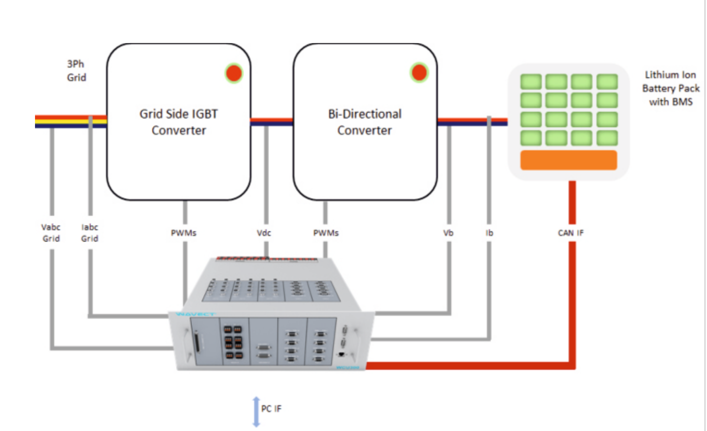
EV – Vehicle Modes

- **Idling**
- **Acceleration**
- **Cruise** (steady state or moderate speed)
- **Creeping** (moving slowly or inching)
- **Deceleration**

EV – Load Emulator Features

- Test Motor Under The Different Loading Conditions
- Bidirectional Loading
- Reproduce The Road Vehicle Conditions
- Track Speed And Torque Profiles With Min. Delay And Max. Accuracy
- Simulate Acceleration, Deceleration, Down Hill Etc.
- User Programmable

EV Battery Charger System



EV Battery Charger System – Key Features

- Dedicated BMS for tracking battery SOC levels etc.
- Dedicated CAN bus for communication of controller to BMS
- User Programmable
- Open hardware charger circuit configuration
- Real Time measurement or terminal voltage for control application purpose
- Real time monitoring and updating of battery conditions
- Support local load on grid or motor setup for drive testing application
- Reference model for basic operation and control

EV Battery Charger – Major Components

Li-Ion Battery Pack with BMS
7.2Kwh, 100Ah, 72V

IGBT Inverter
Supports bi-directional power flow (G2B, B2G)
15 KVA
Forced Air Cooling

WCU300 Real Time Controller
Advanced Processing, Voltage/Current Sensors, PWMs, Encoders, Communication

IGBT Buck Boost Converter
6KW,
In: 300-700VDC,
Out: 100-200 VDC, 60 Amps (Buck), 30 Amps(Boost)

Model Based Development
Powerful, Ease to use
Auto Code generation
Suite – Real Time Signals Software