Research Activities of Electric Machinery and Control Laboratory

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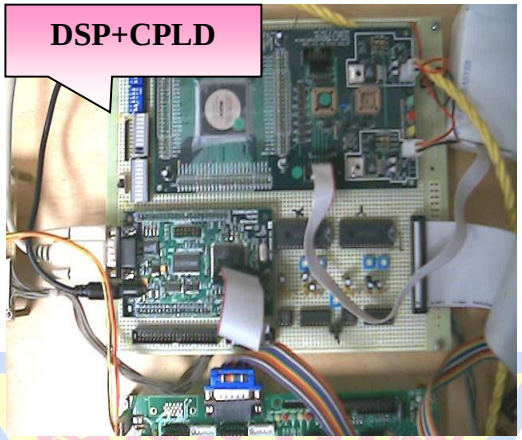
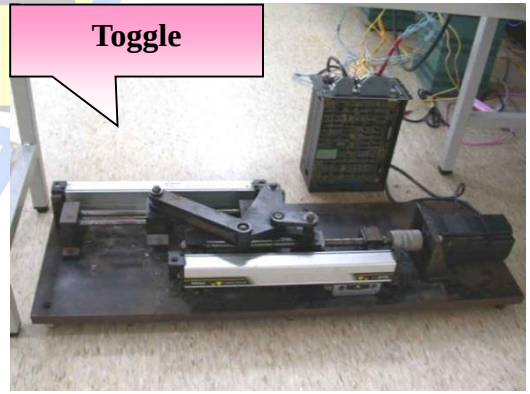
Areas of Research

- **Intelligent control systems including fuzzy, neural network and GA**
- **Ultrasonic, synchronous and induction motor servo drives (rotating and linear)**
- **Magnetic levitation**
- **Piezoceramic actuator**
- **Induction generator system**
- **Nonlinear and adaptive control**
- **Power electronics**
- **Renewable Energy**
- **Microgrid**
- **DSP-based computer control systems and computer interface**
- **Digital and analog circuits, VHDL, Spice**

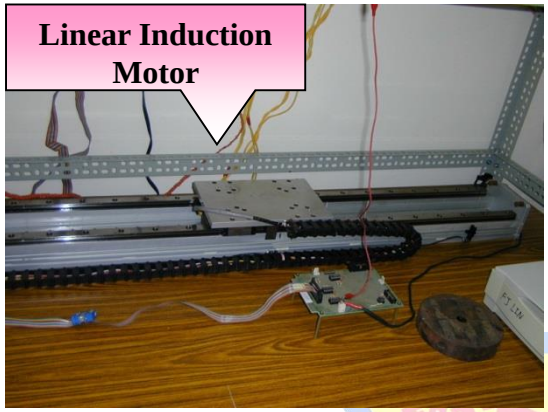
Experimental Equipments



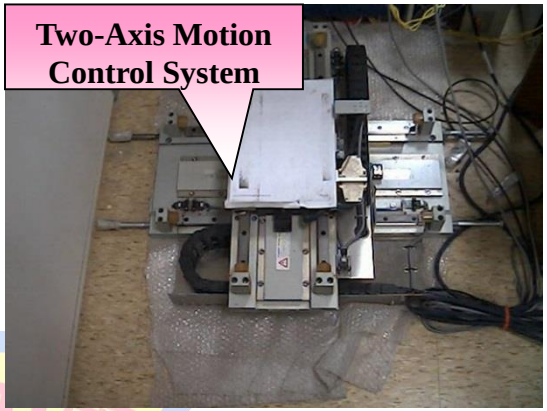


Experimental Equipments

Linear Induction Motor

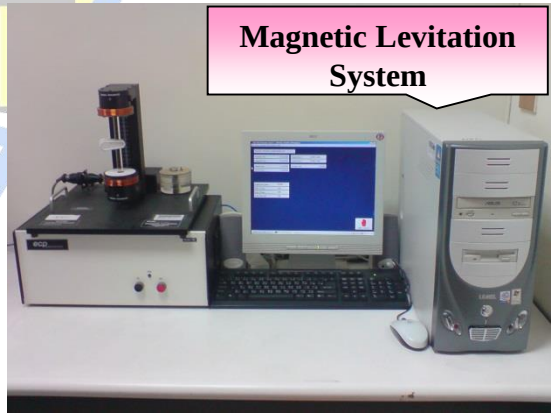


Two-Axis Motion Control System

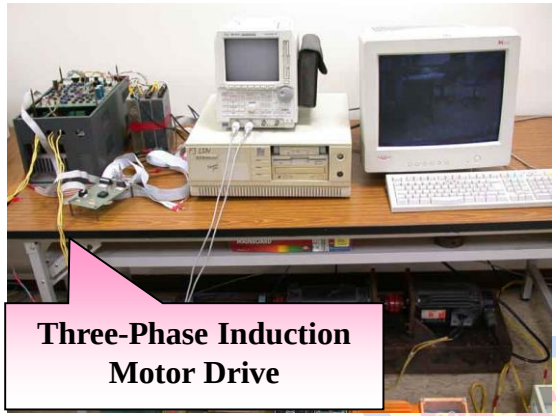


Five Degree-of-Freedom Active Magnetic Bearing Control System

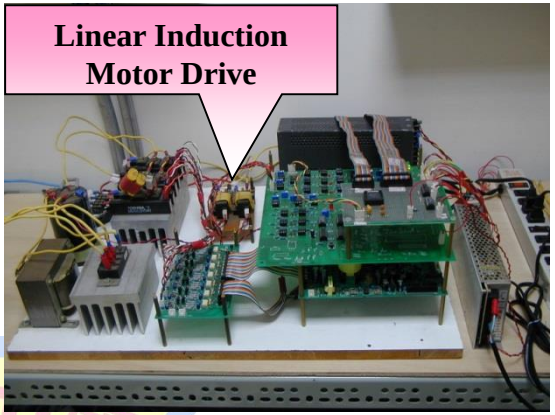
Magnetic Levitation System



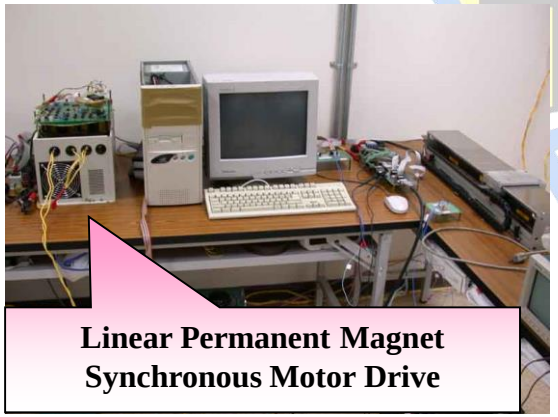
Experimental Equipments



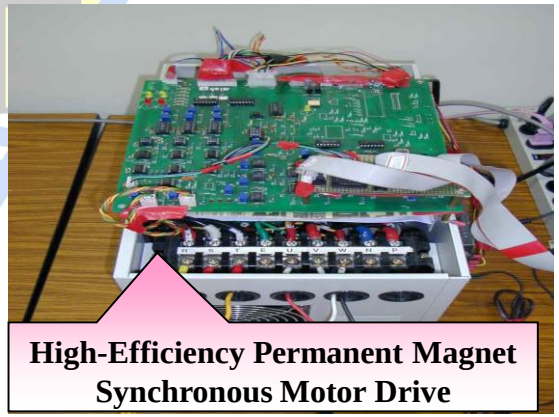
Three-Phase Induction Motor Drive



Linear Induction Motor Drive



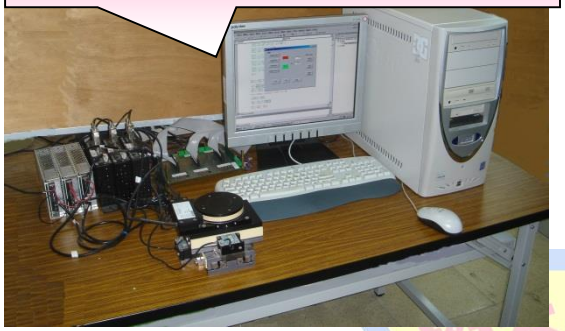
Linear Permanent Magnet Synchronous Motor Drive

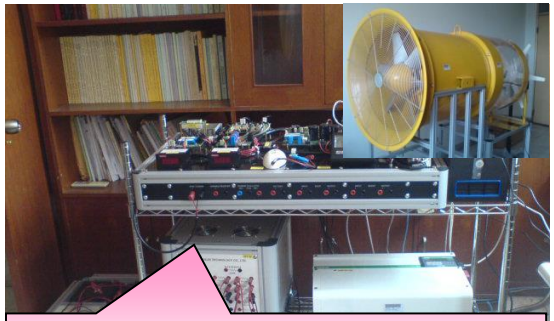


High-Efficiency Permanent Magnet Synchronous Motor Drive

Experimental Equipments

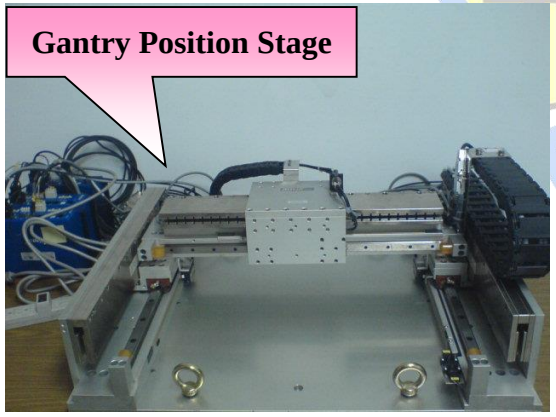
Three-Axis Stage with Linear Ultrasonic Motors



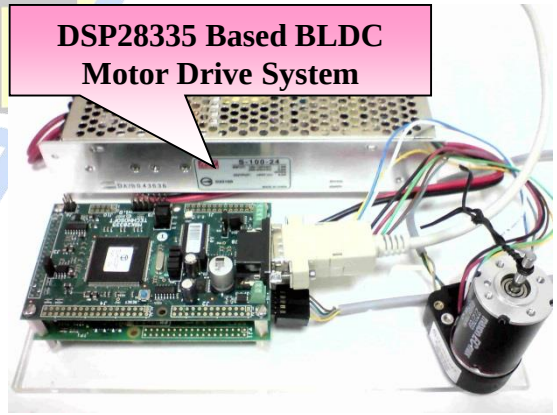


Permanent Magnet Synchronous Wind-Turbine Generator

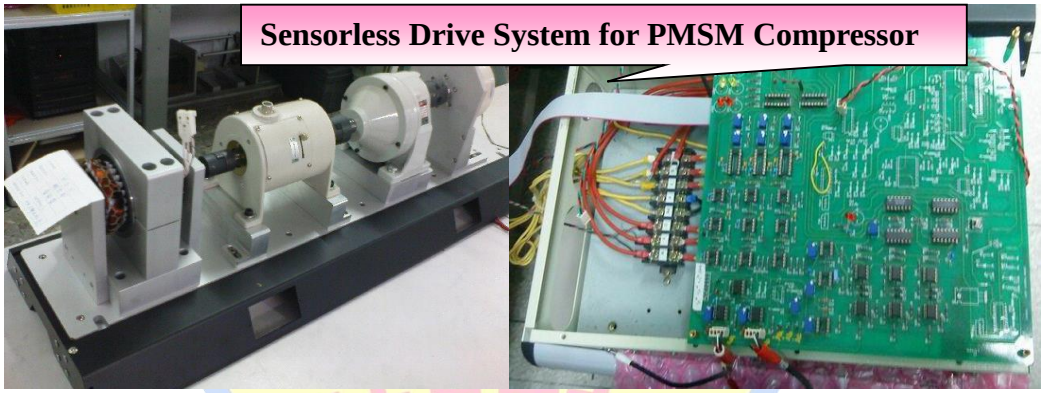
Gantry Position Stage

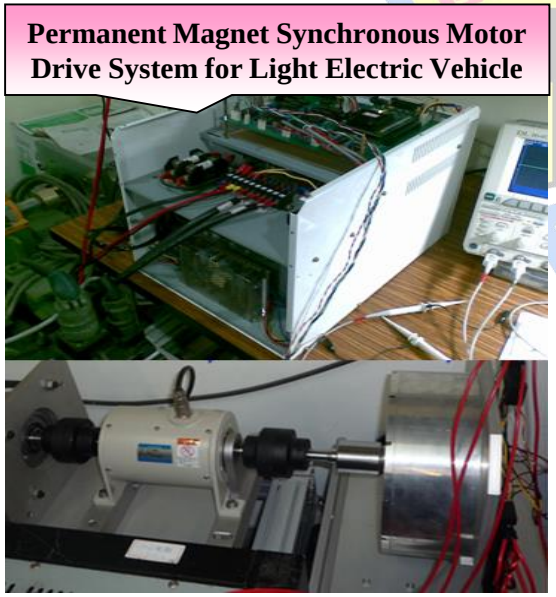


DSP28335 Based BLDC Motor Drive System



Experimental Equipments

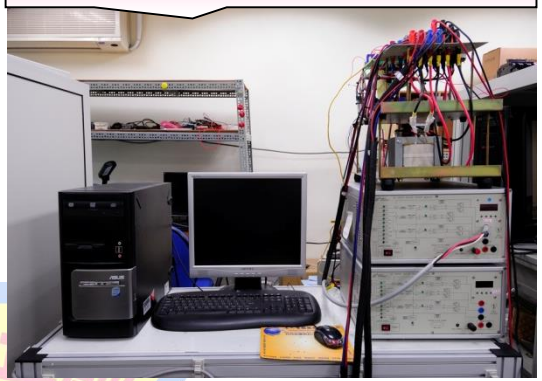




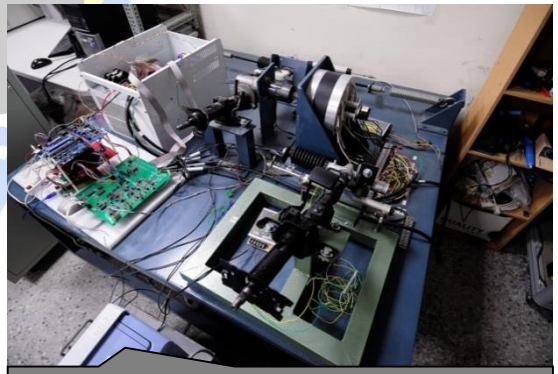
Experimental Equipments

Wind Turbine Emulator and Induction Generator

Converter and Inverter for WTG



Inverter System for Microgird



Electric Power Steering Emulator

Experimental Equipments

Dynamic Signal Analyzer

Programmable AC Power Sources

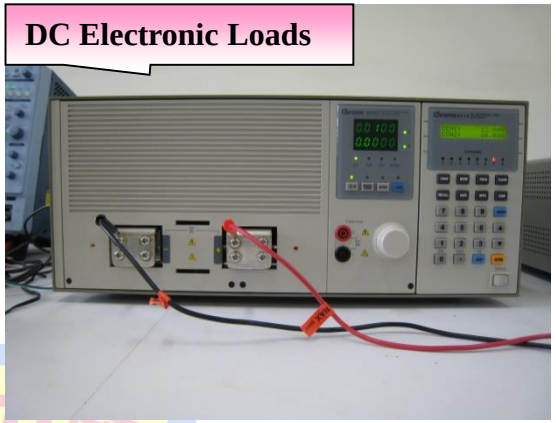
Precision LCR Meter

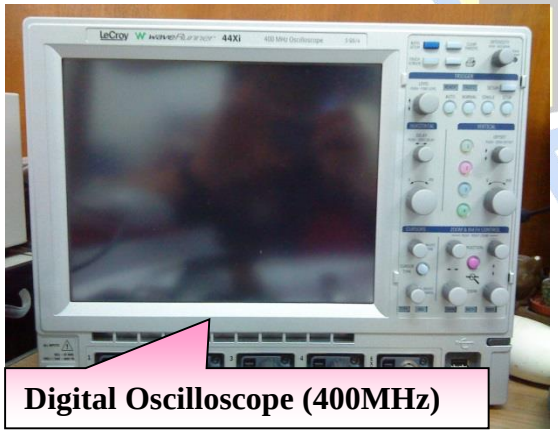
Digital Oscilloscope

Experimental Equipments

DC Power Supply (200V/25A)

DC Electronic Loads





Digital Oscilloscope (400MHz)

Programmable AC Power Sources

Experimental Equipments

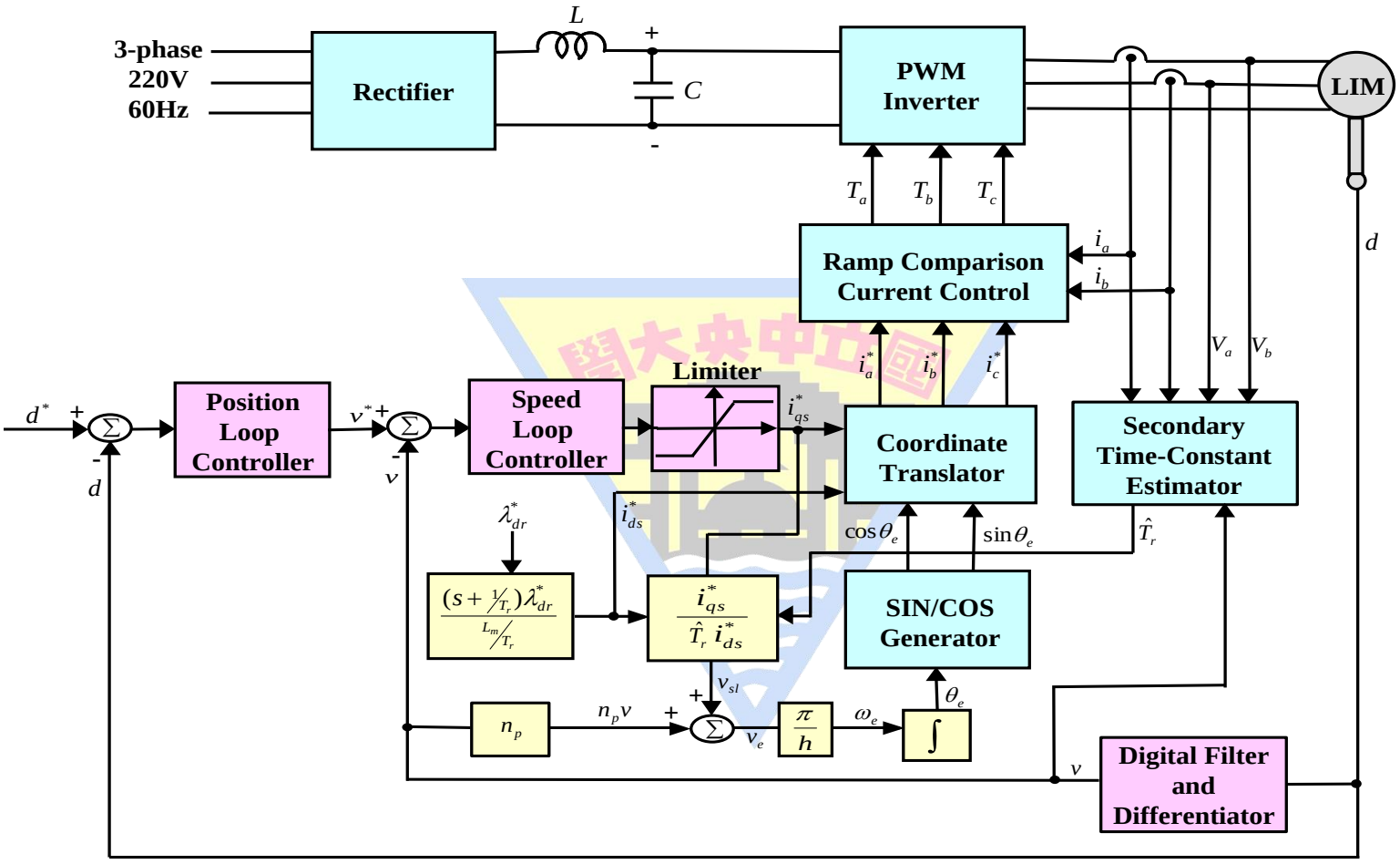
Programable 3-phase Power Source

PV Emulator

Three-Phase Power Analyzer

Research Achievements

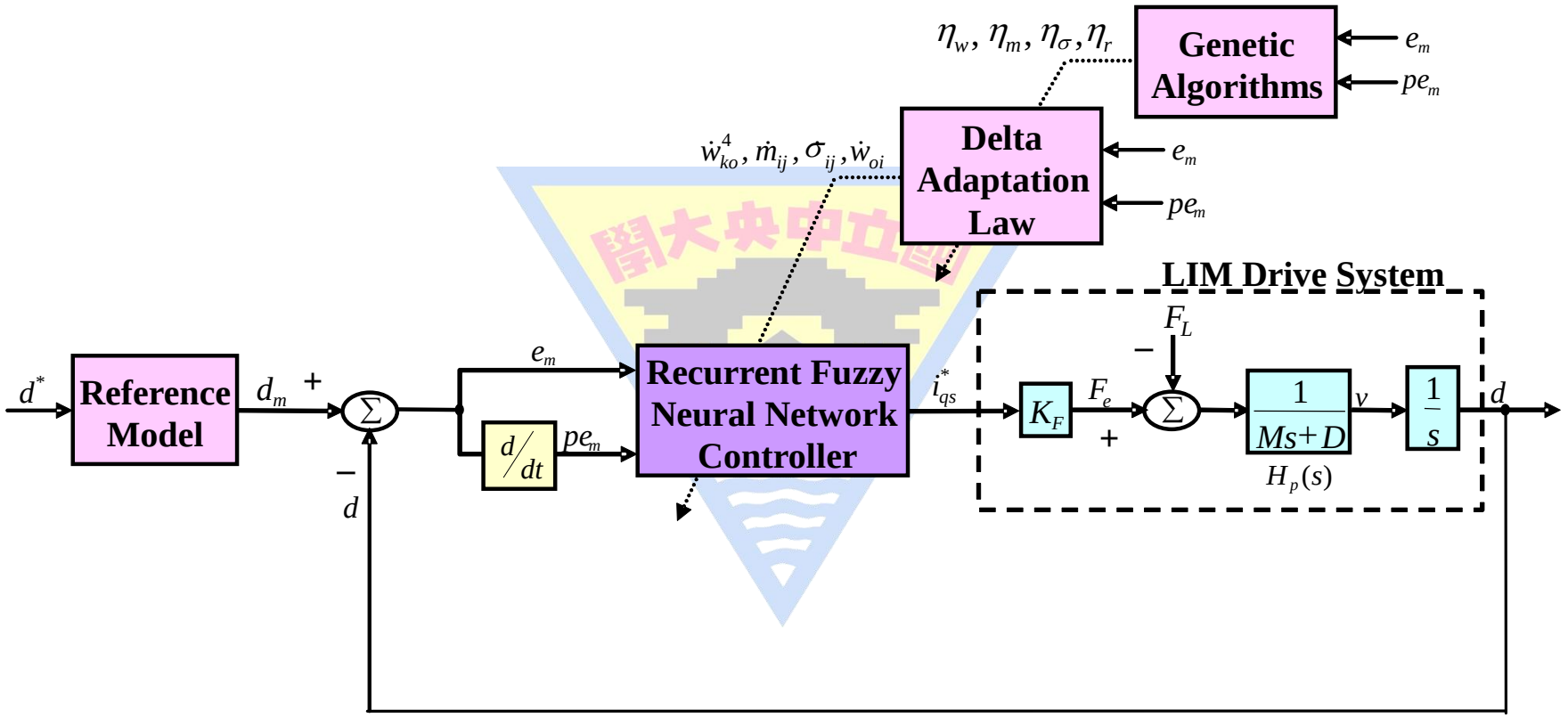
Recurrent-Fuzzy-Neural-Network Control Linear Induction Motor Servo Drive Using Genetic Algorithm



System configuration of indirect field-oriented control LIM servo drive

Research Achievements

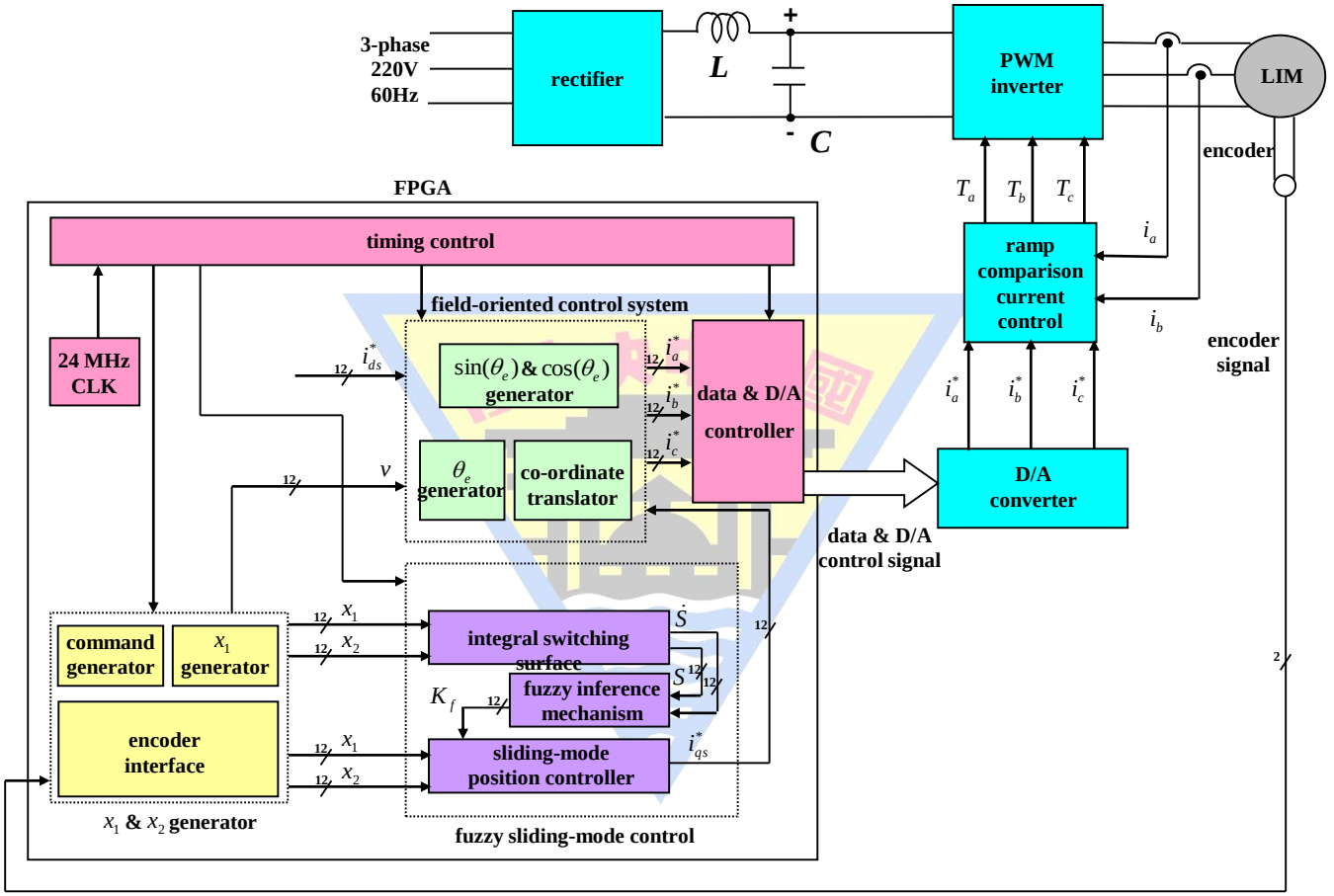
Recurrent-Fuzzy-Neural-Network Control Linear Induction Motor Servo Drive Using Genetic Algorithm



Control block of LIM servo drive with GA-based RFNN controller

Research Achievements

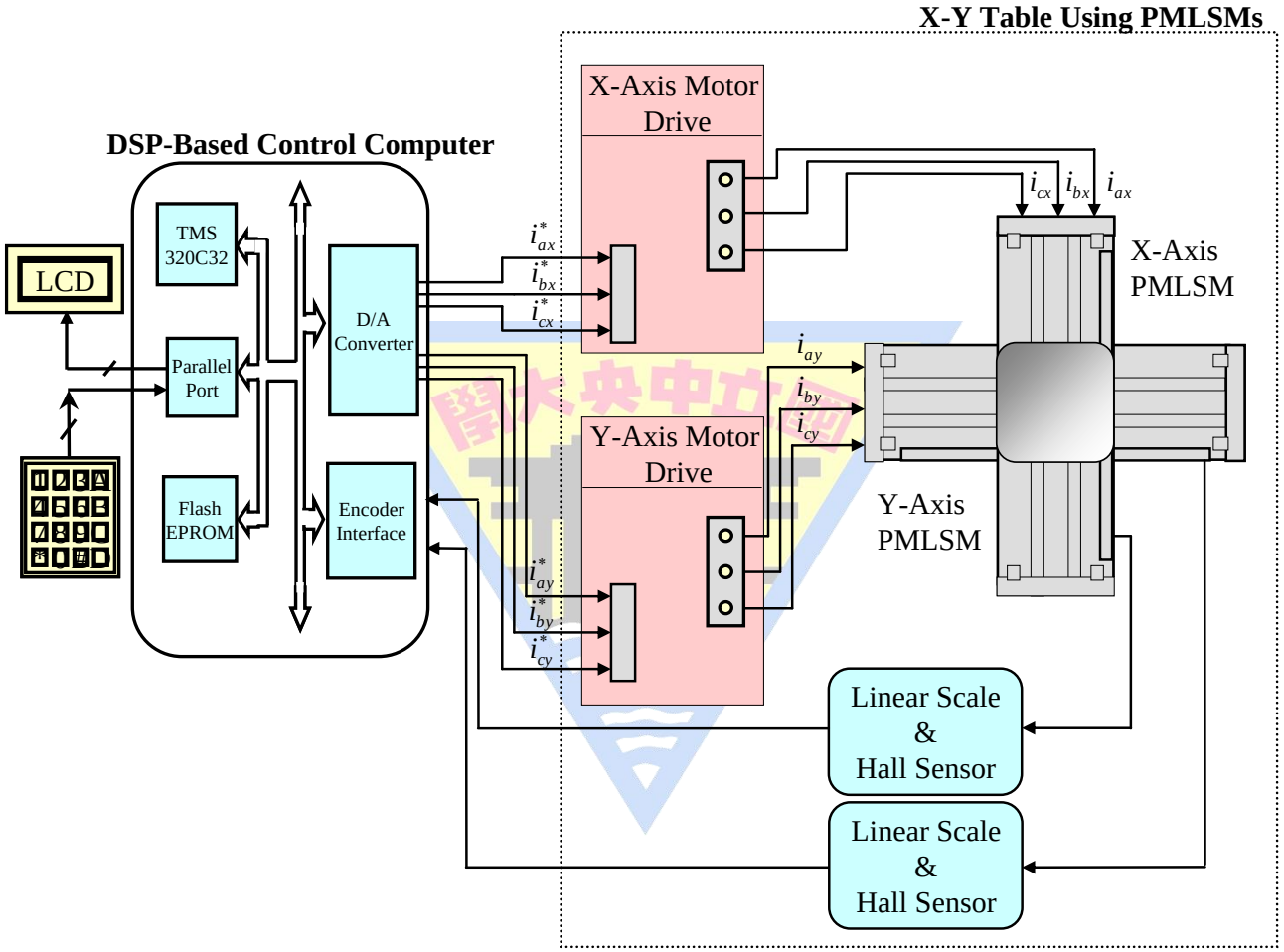
Fuzzy Sliding-Mode Control Linear Induction Motor Drive Using FPGA



Control block of FPGA-based LIM servo drive

Research Achievements

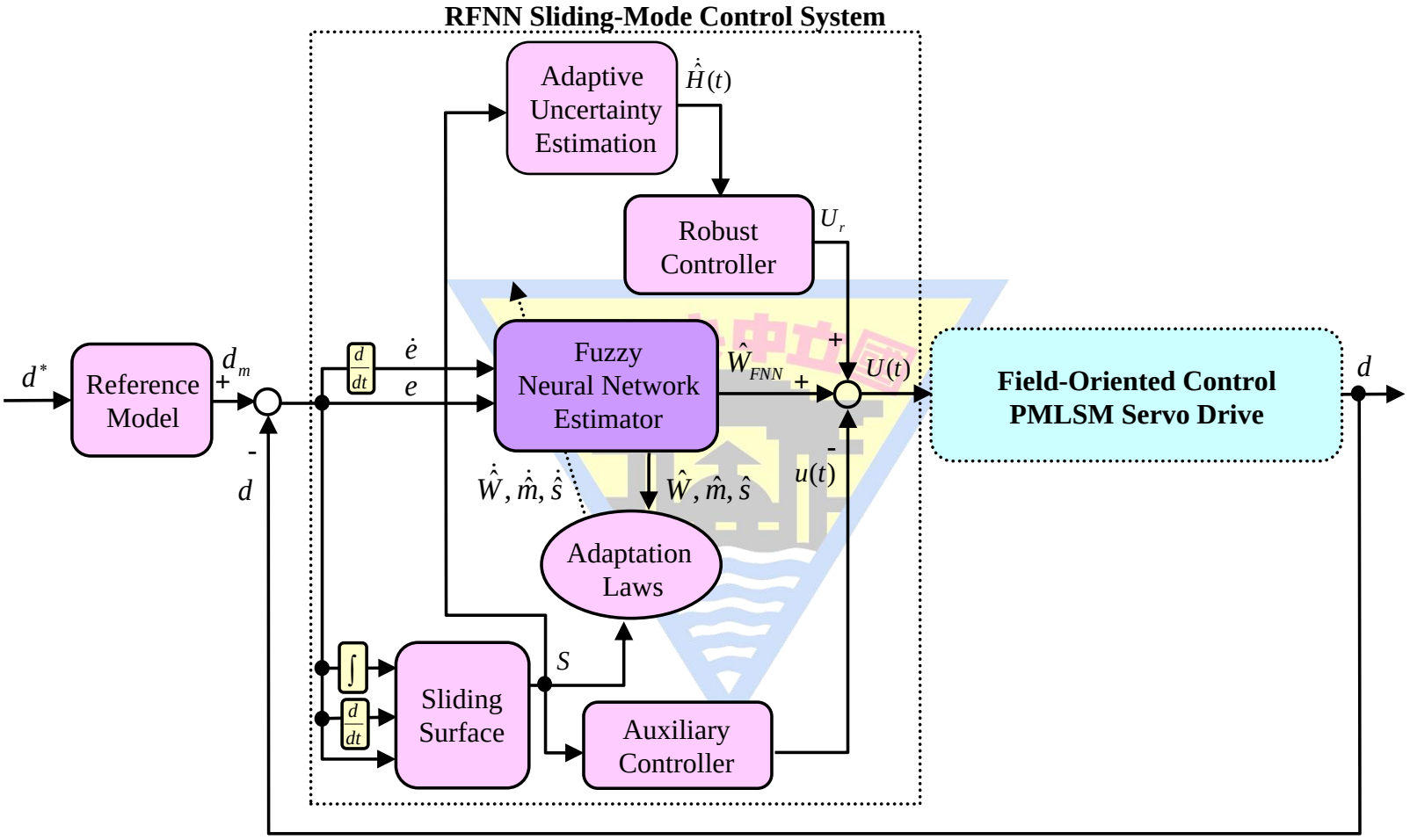
Robust Fuzzy-Neural-Network Sliding-Mode Control for Two-Axis Motion Control System



DSP-based two-axis motion control system

Research Achievements

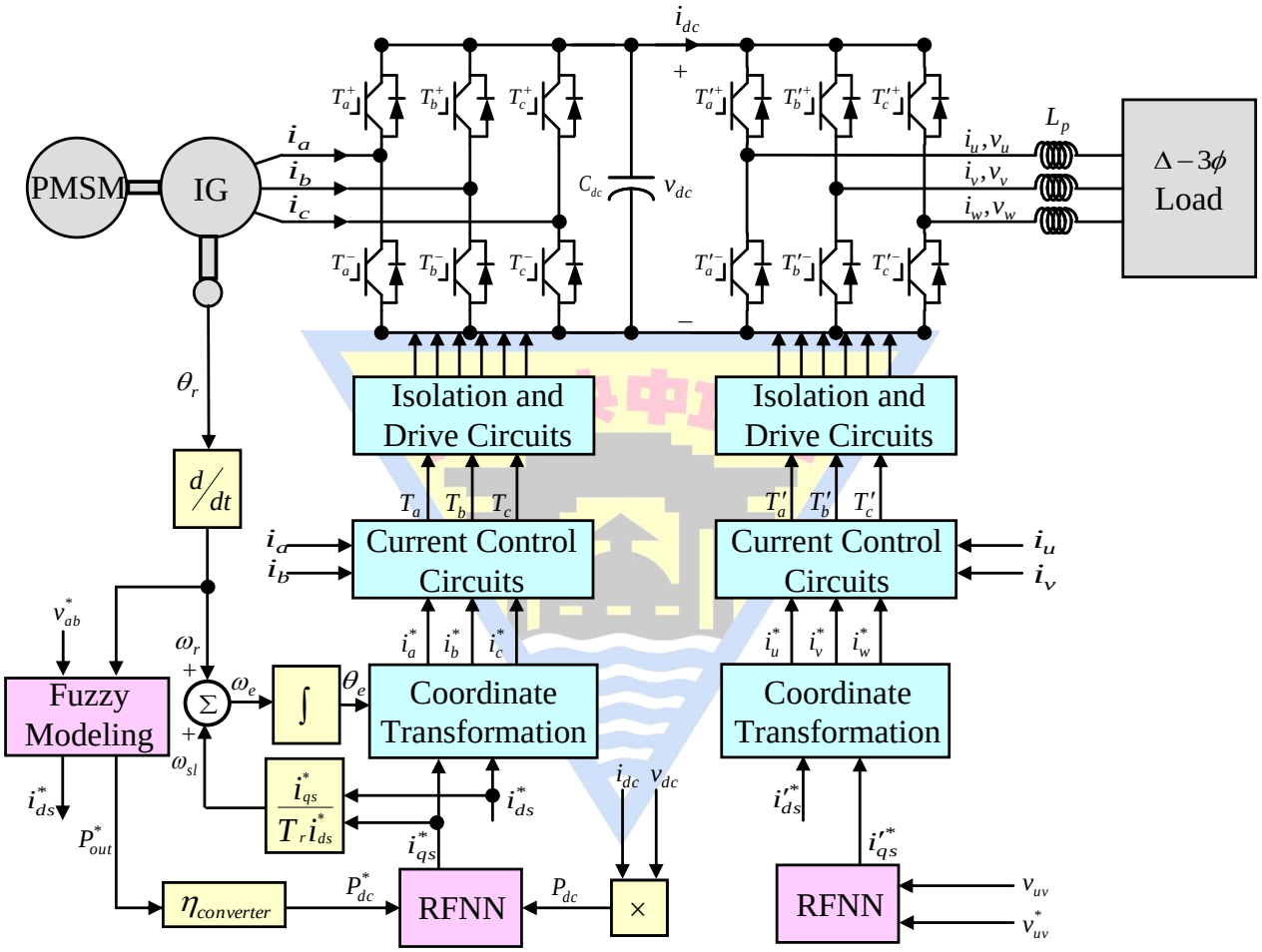
Robust Fuzzy-Neural-Network Sliding-Mode Control for Two-Axis Motion Control System



RFNN sliding-mode control system

Research Achievements

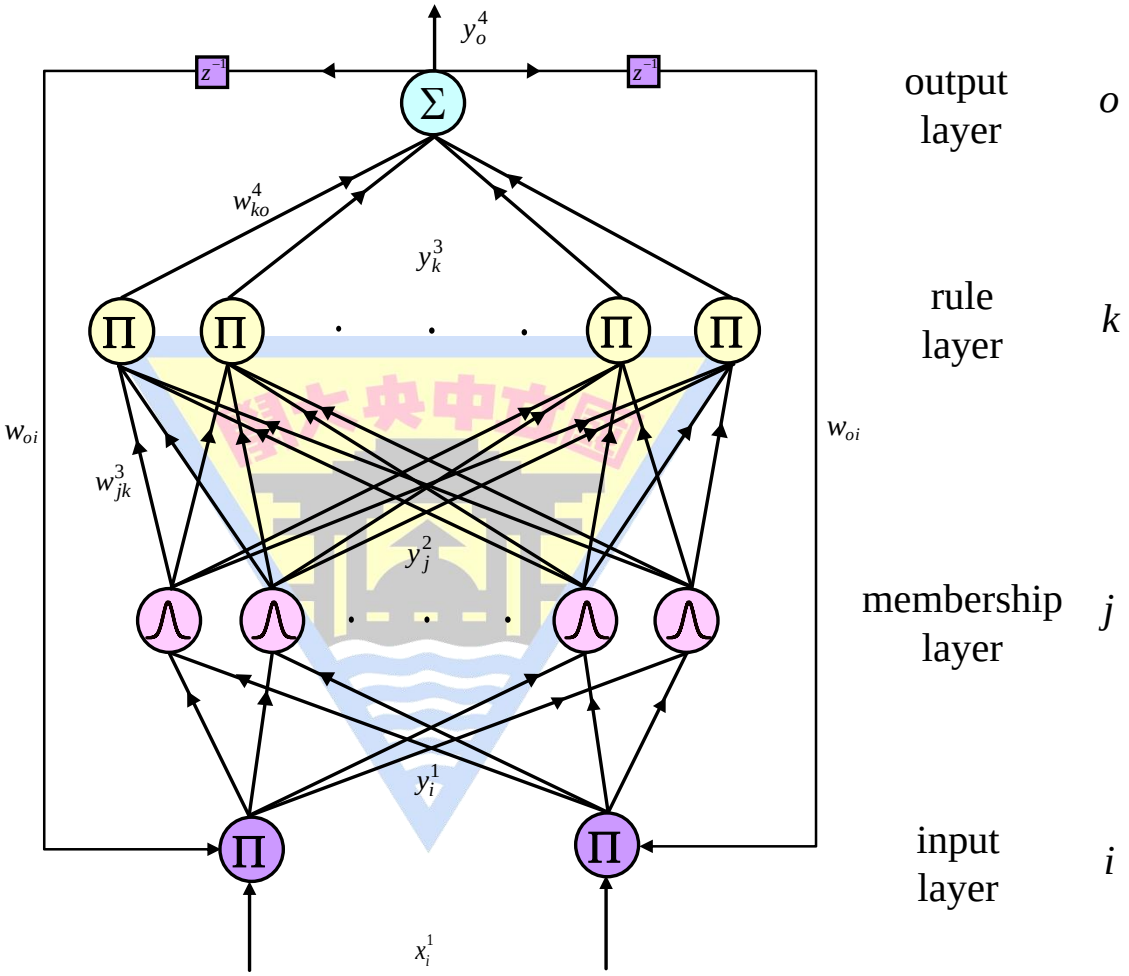
Frequency Control Induction Generator System Using Recurrent-Fuzzy-Neural-Network



Control block of induction generator system with RFNN control

Research Achievements

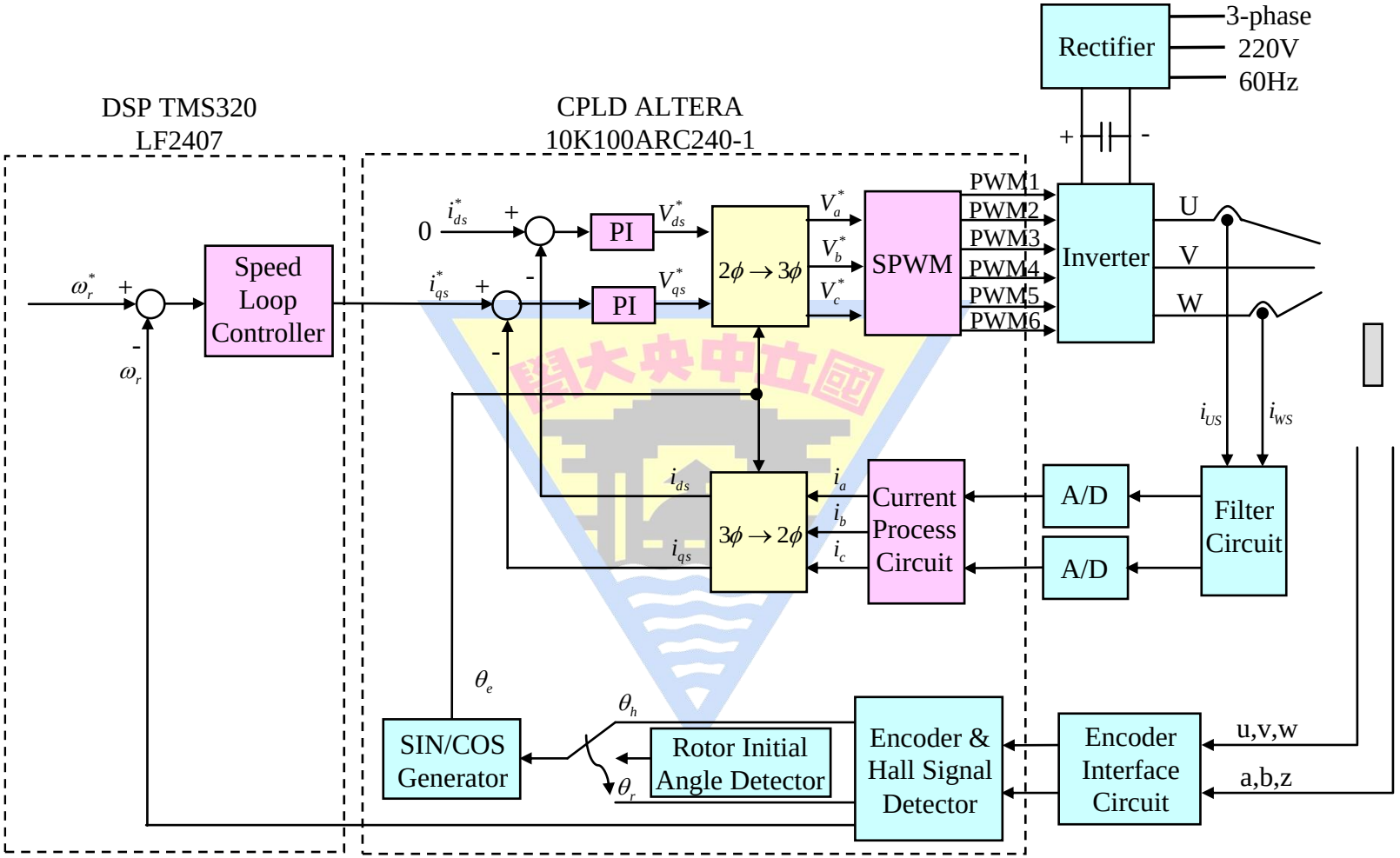
Frequency Control Induction Generator System Using Recurrent-Fuzzy-Neural-Network



Structure of four-layer RFNN

Research Achievements

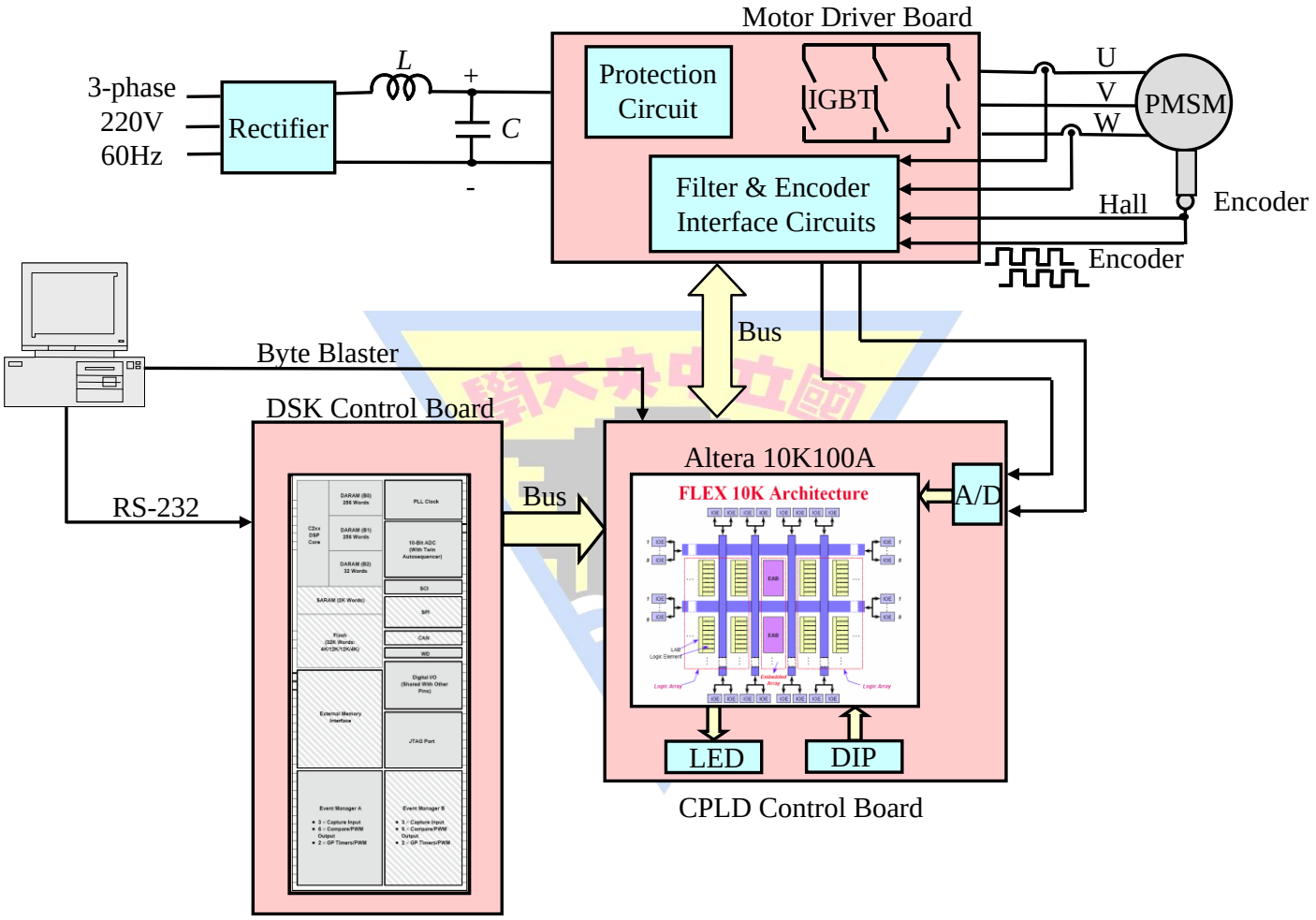
Synchronous Motor Drive System Using DSP and CPLD



System configuration of field-oriented control PMSM servo drive

Research Achievements

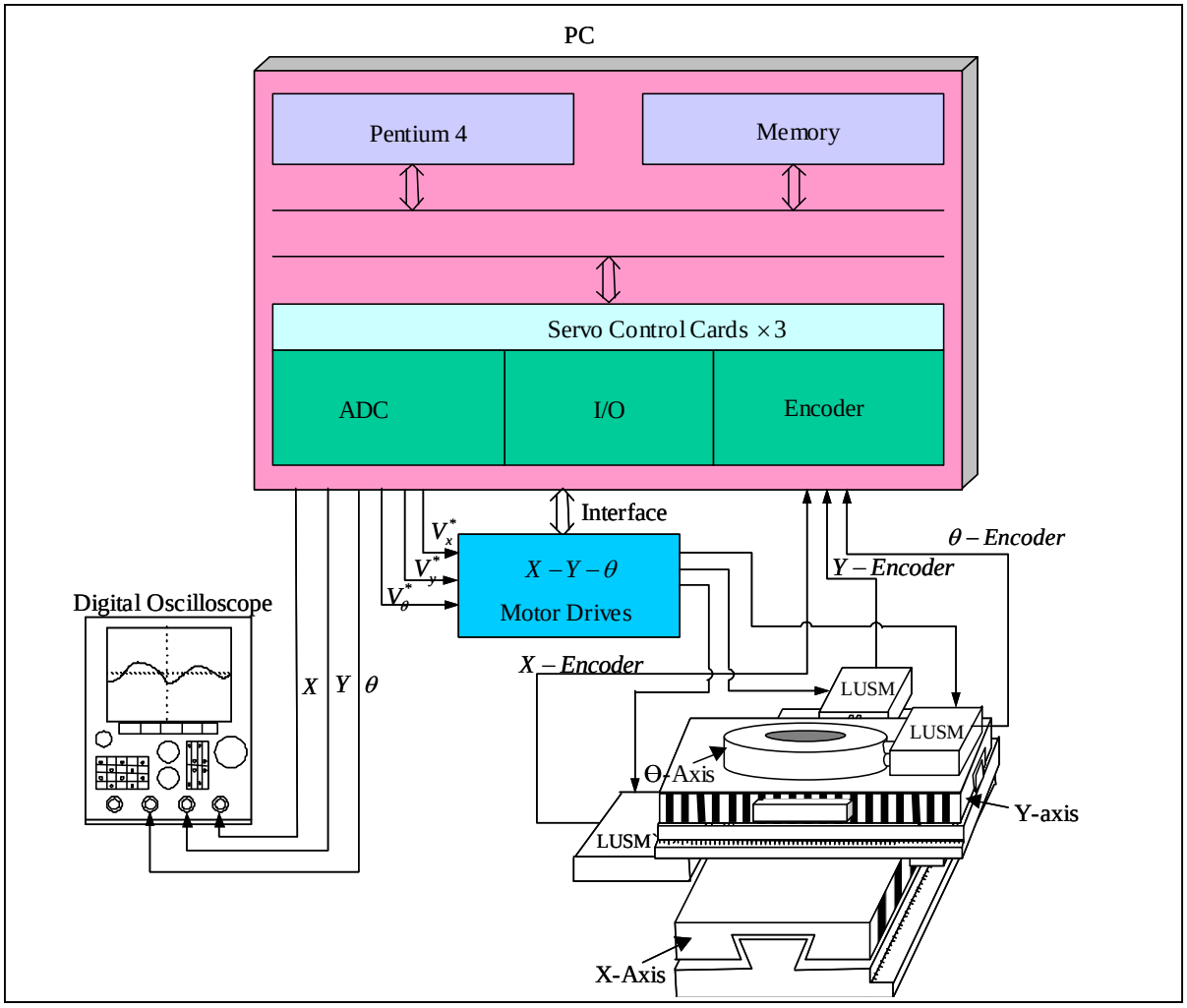
Synchronous Motor Drive System Using DSP and CPLD



System block of PMSM servo drive

Research Achievements

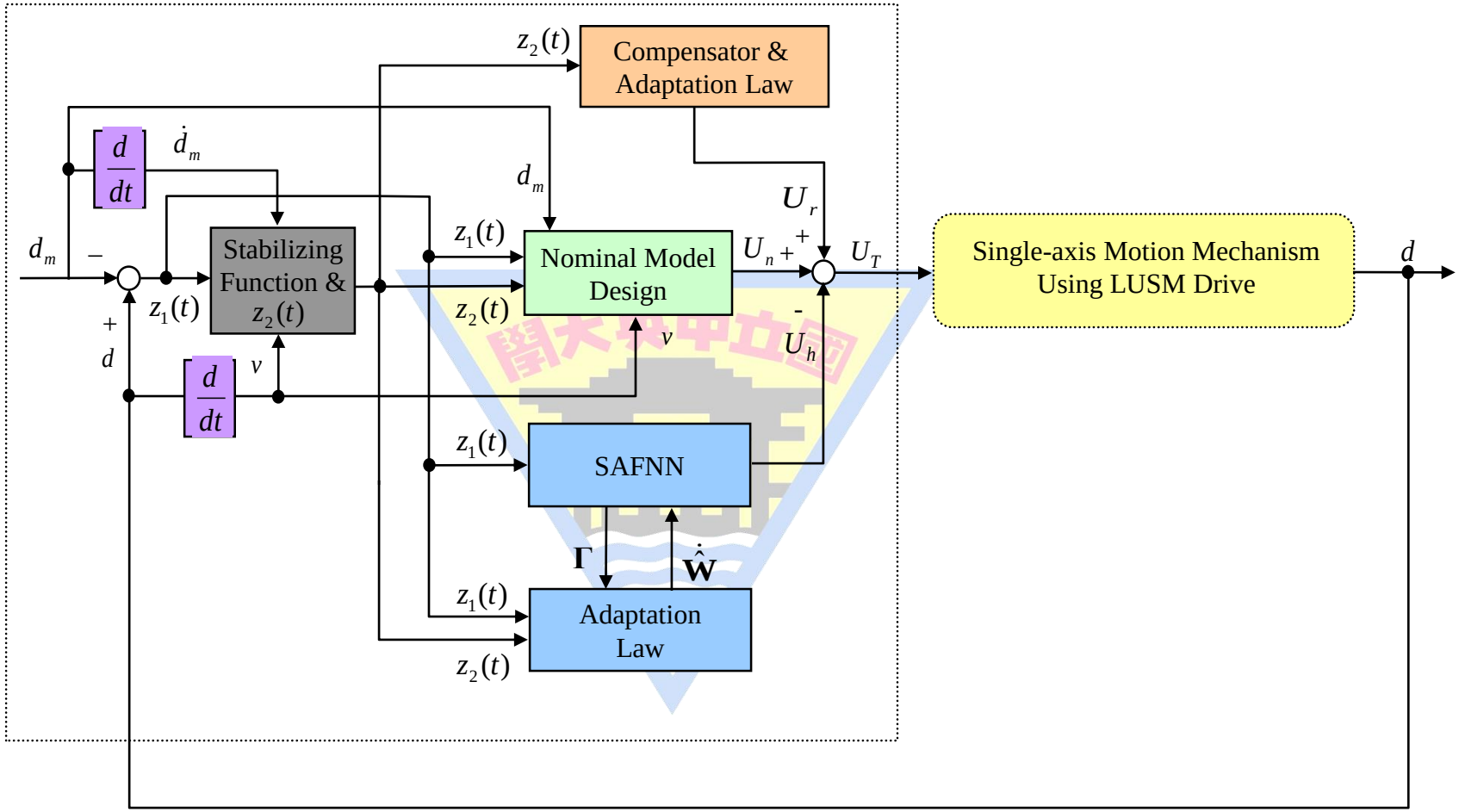
X-Y-θ Motion Control Stage Using Linear Ultrasonic Motors



System block of X-Y-θ motion control stage

Research Achievements

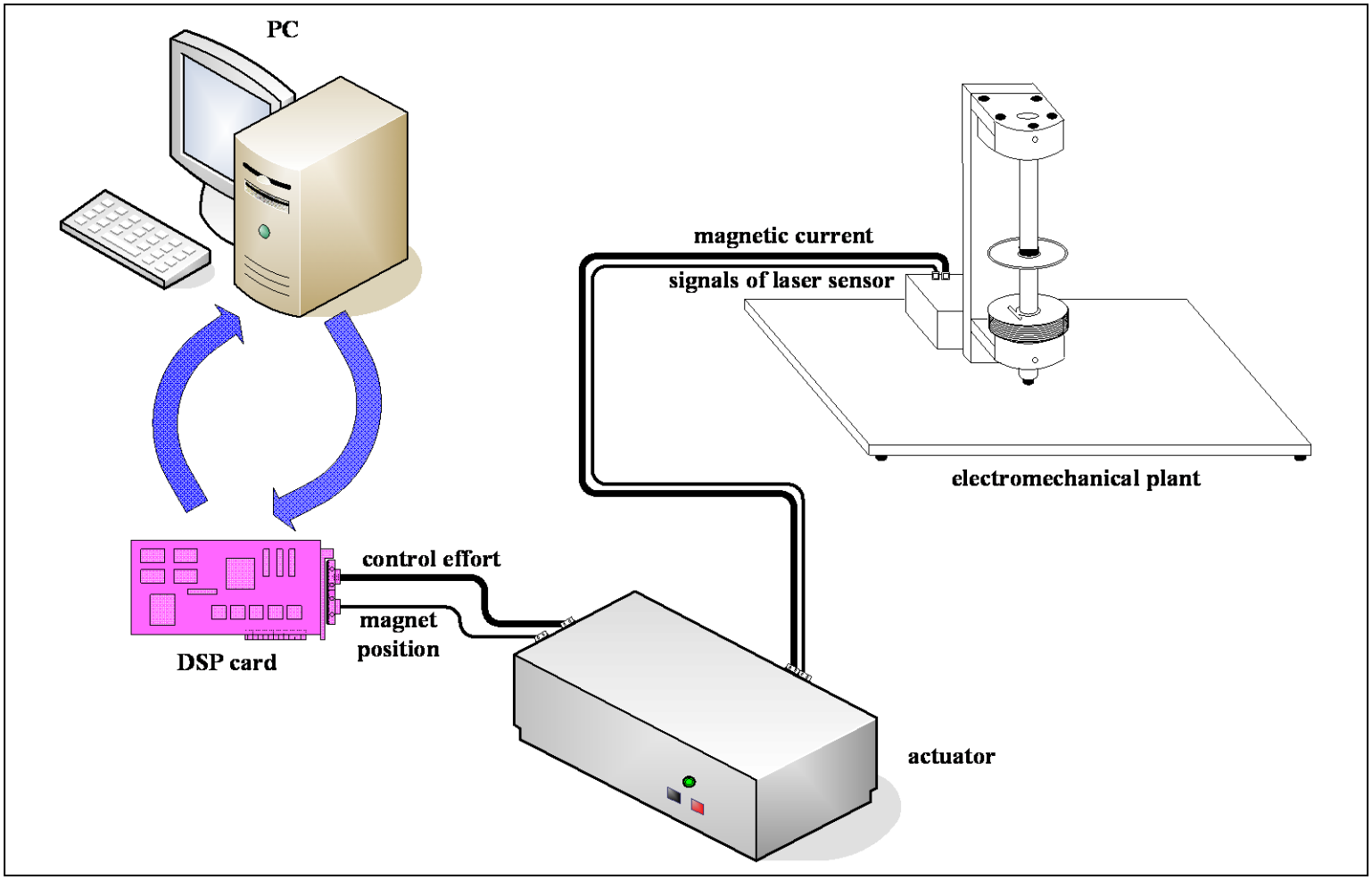
X-Y-θ Motion Control Stage Using Linear Ultrasonic Motors



Robust SAFNN backstepping control system

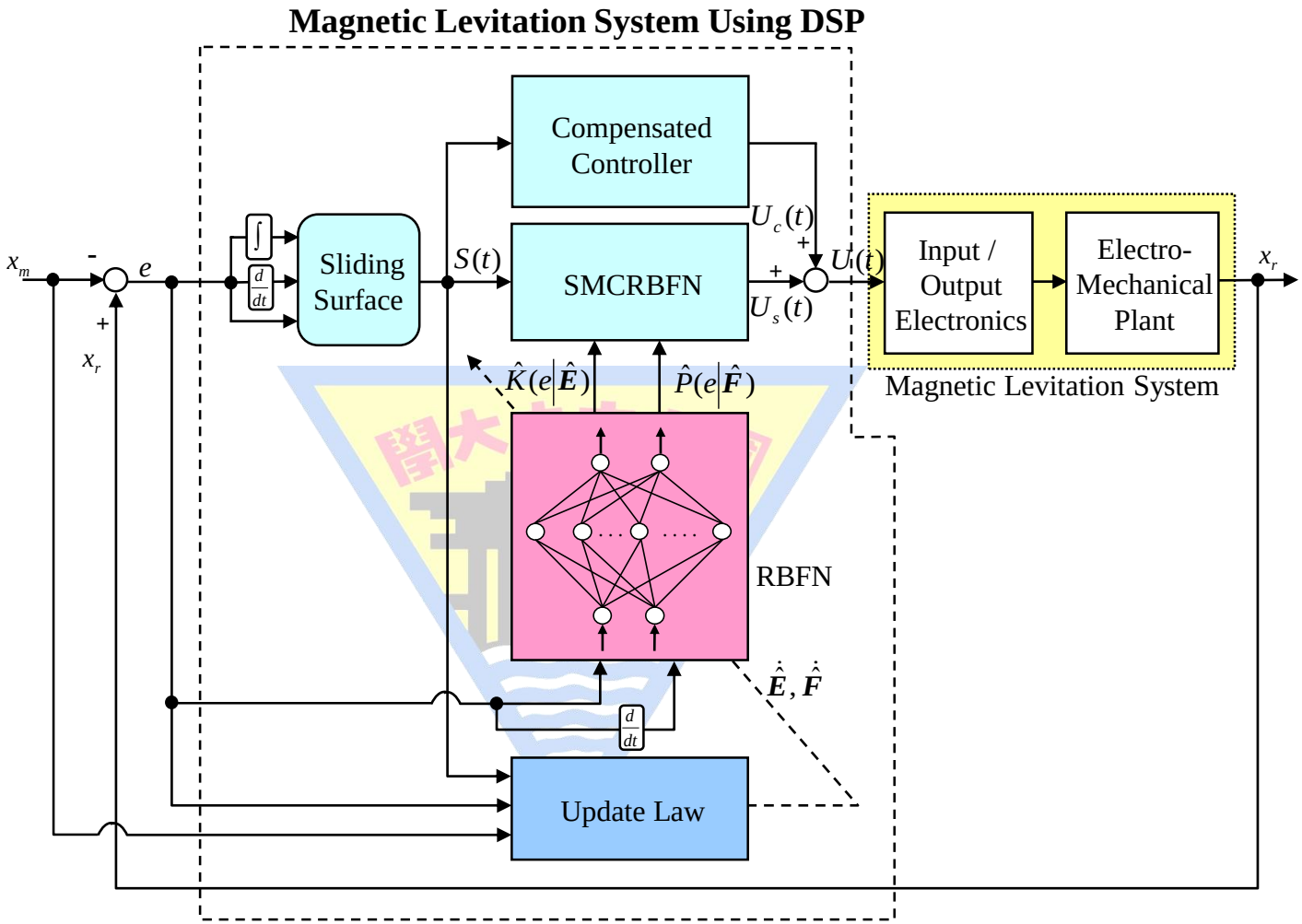
Research Achievements

Magnetic Levitation System Using DSP



System block of magnetic levitation apparatus

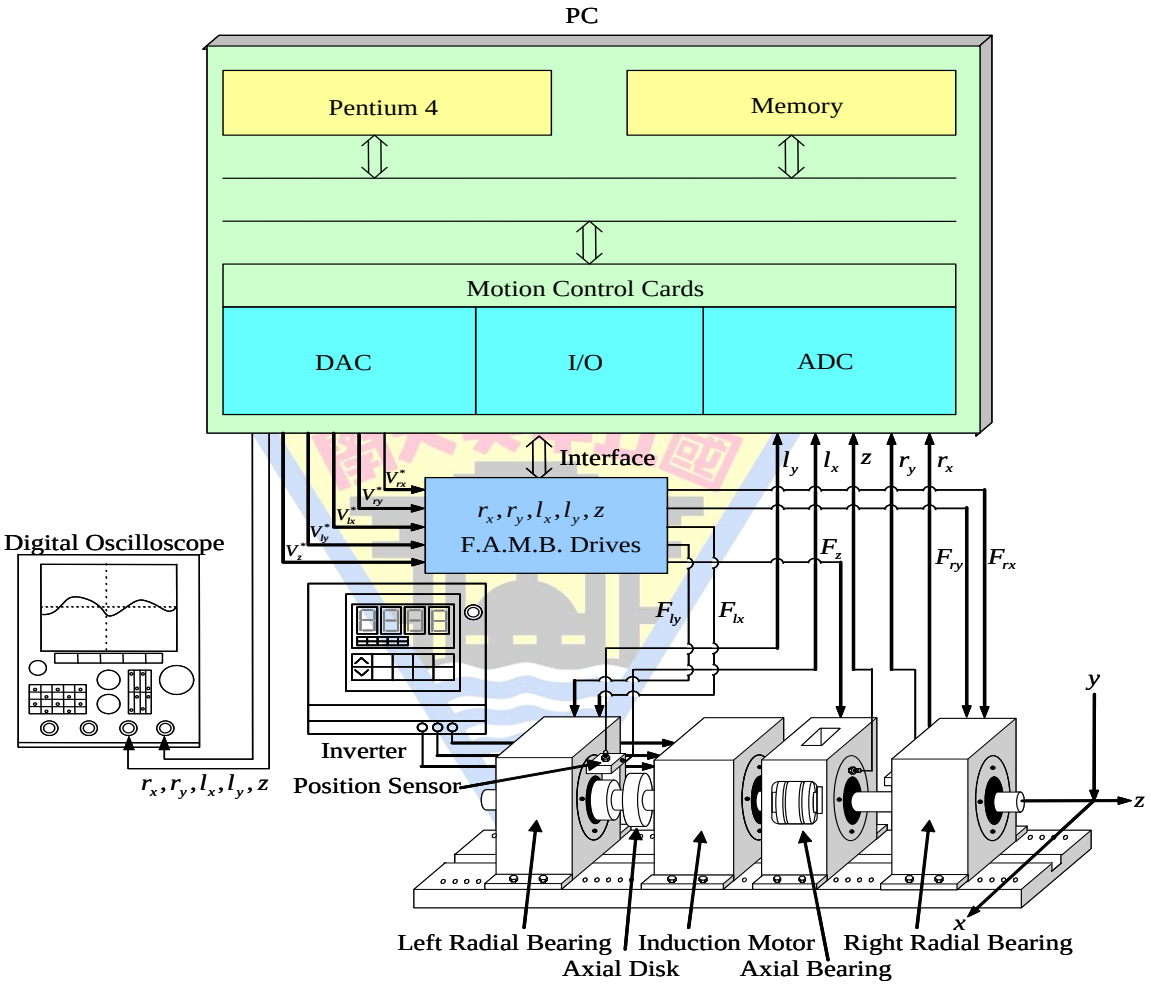
Research Achievements



Intelligent sliding-mode control system using a radial basis function network (SMCRBFN)

Research Achievements

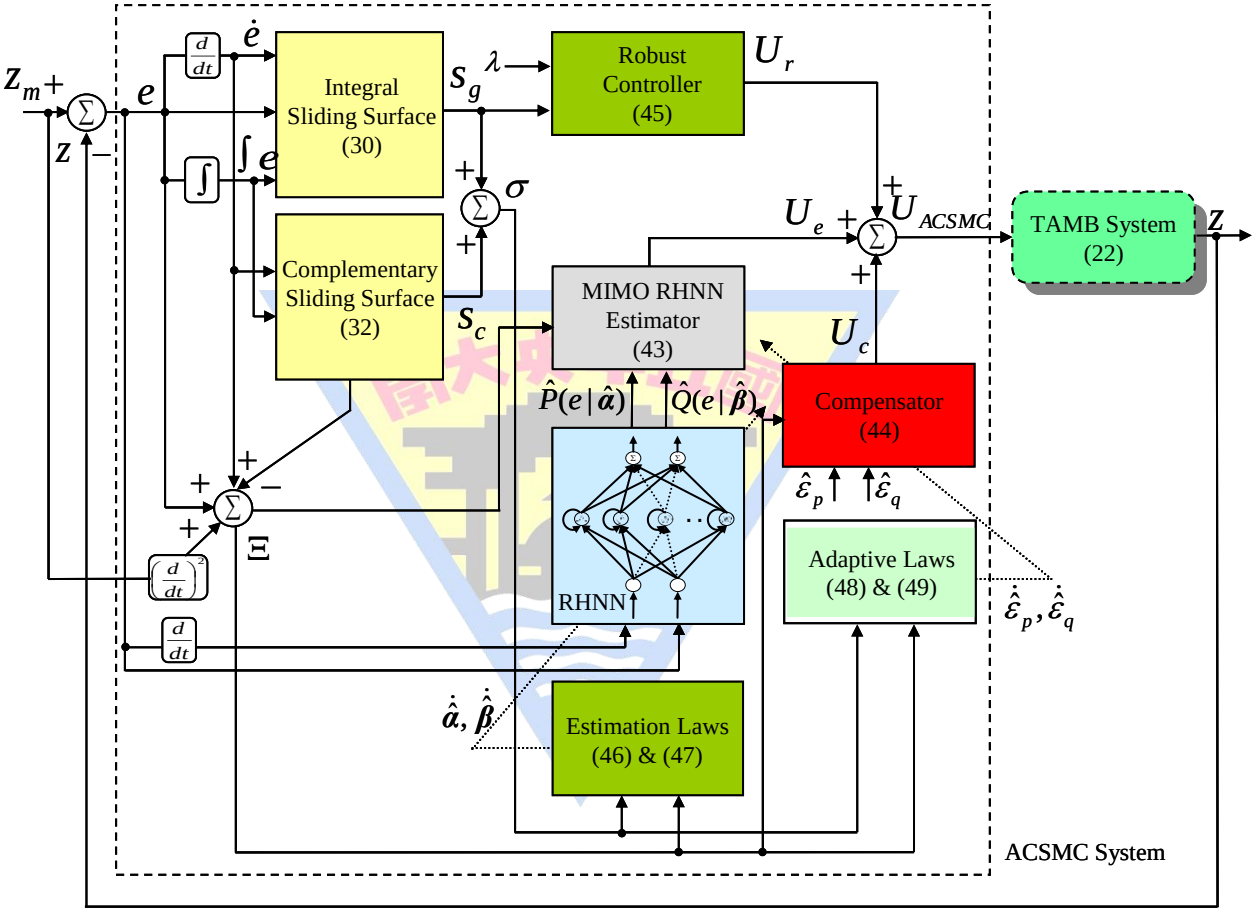
Five degree-of-freedom active magnetic bearing system using PC



System block of five degree-of-freedom active magnetic bearing

Research Achievements

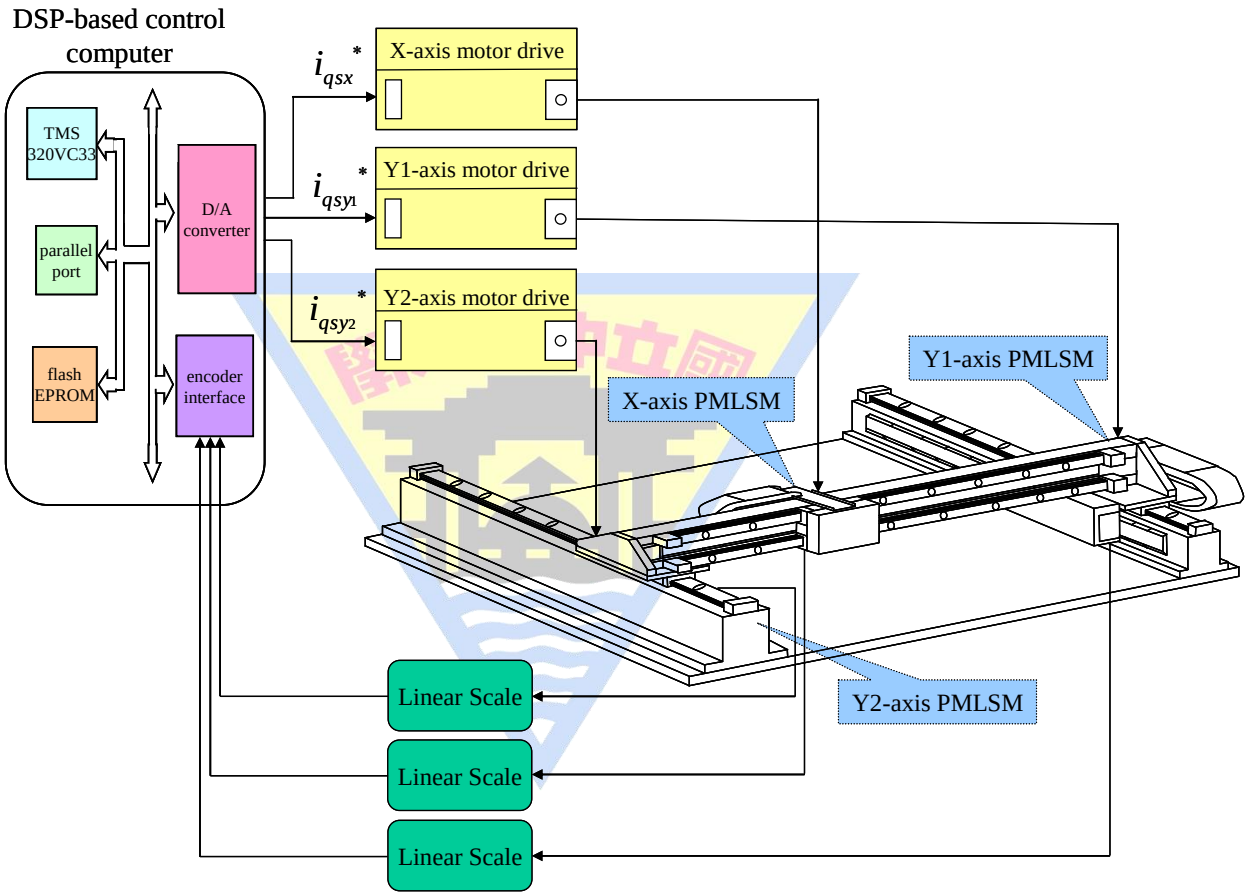
Five degree-of-freedom active magnetic bearing system using PC



Adaptive complementary sliding-mode control system using Hermite neural network

Research Achievements

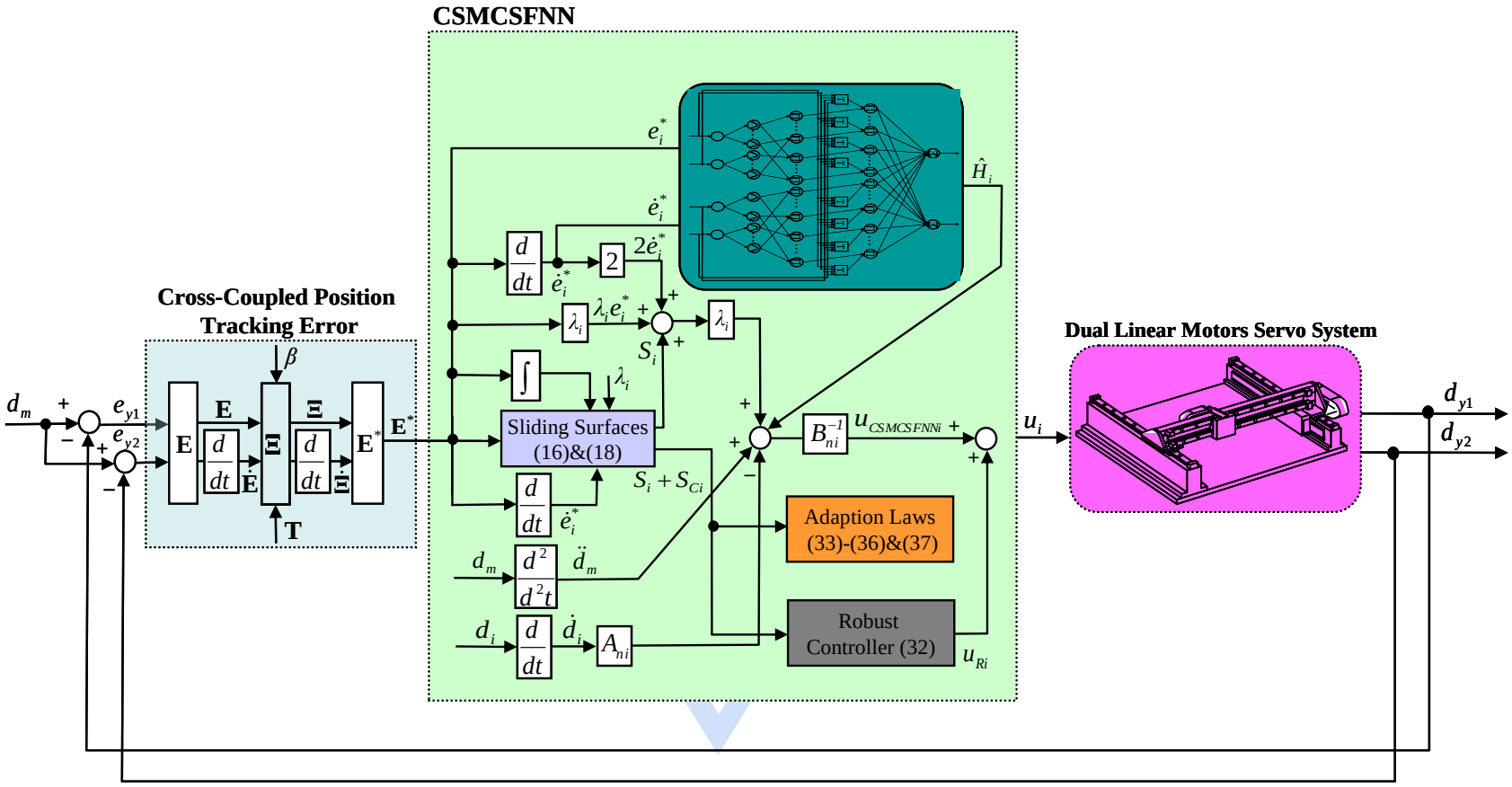
Gantry position stage using DSP



System block of gantry position stage

Research Achievements

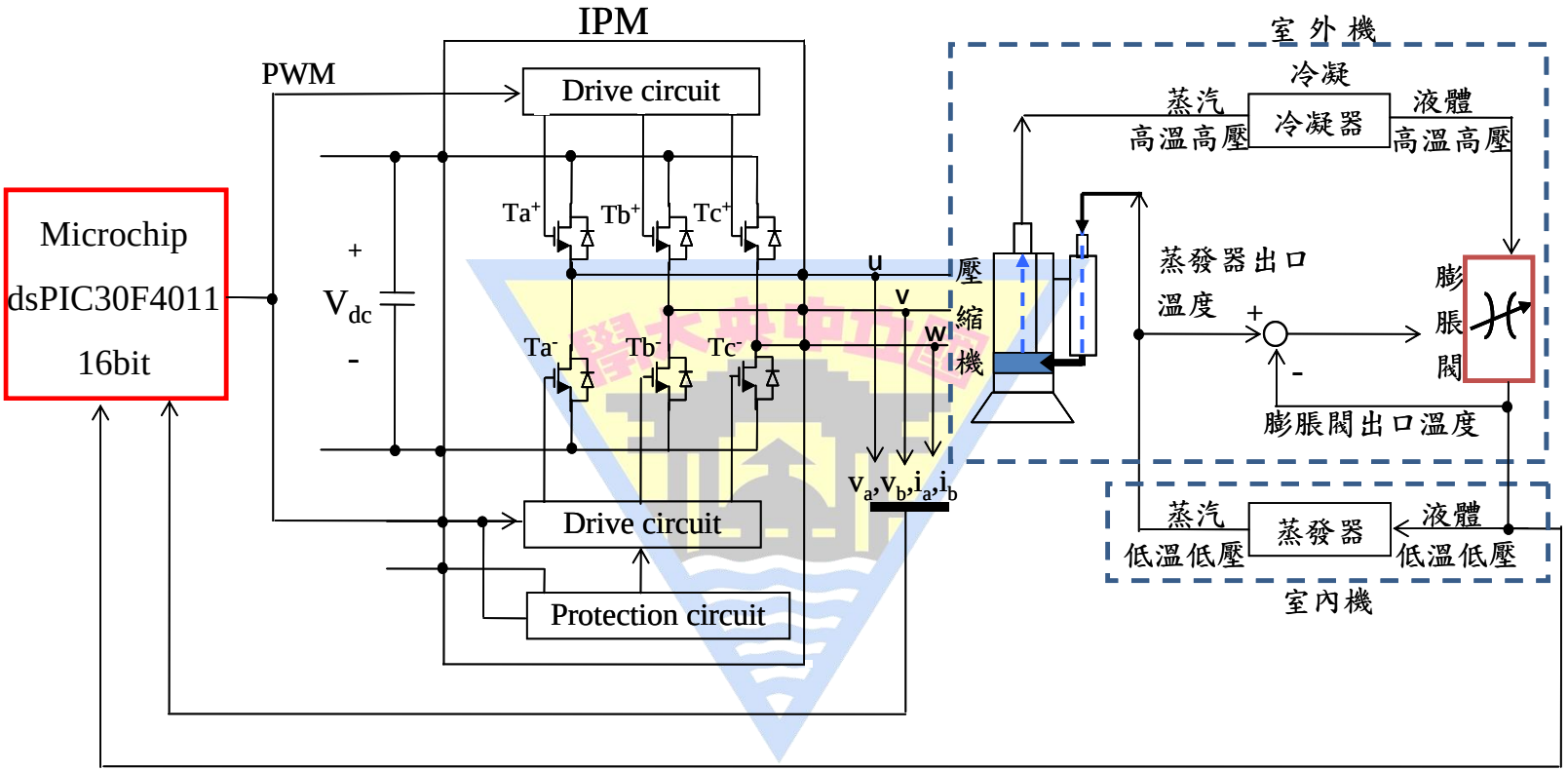
Gantry position stage using DSP



Cross-coupled synchronous control using Sugeno type fuzzy neural network estimator

Research Achievements

Sensorless drive system for PMSM compressor using dsPIC

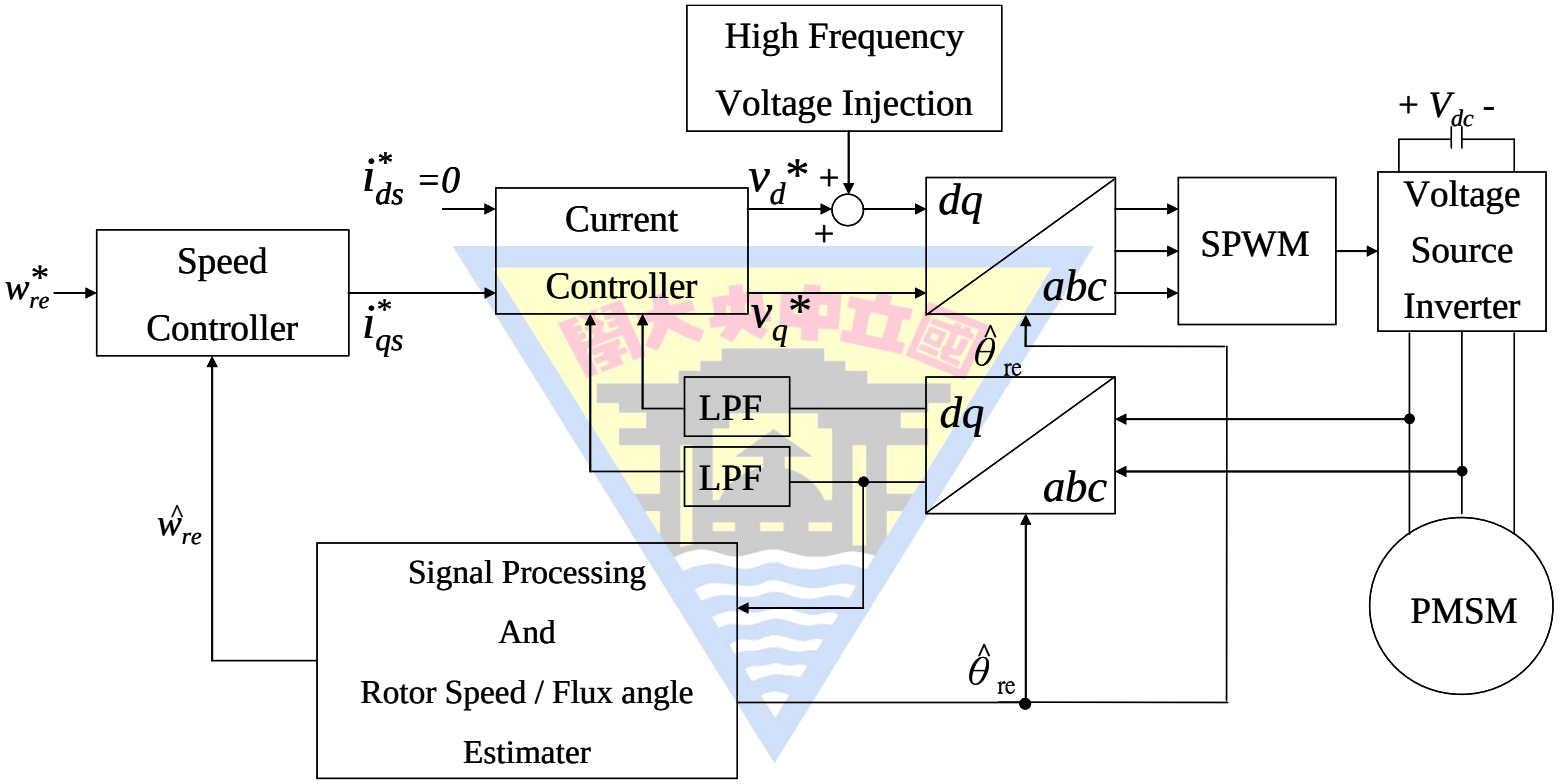


出風口與蒸發器入口溫度、膨脹閥兩側壓力與溫度

System block of sensorless drive system for PMSM compressor

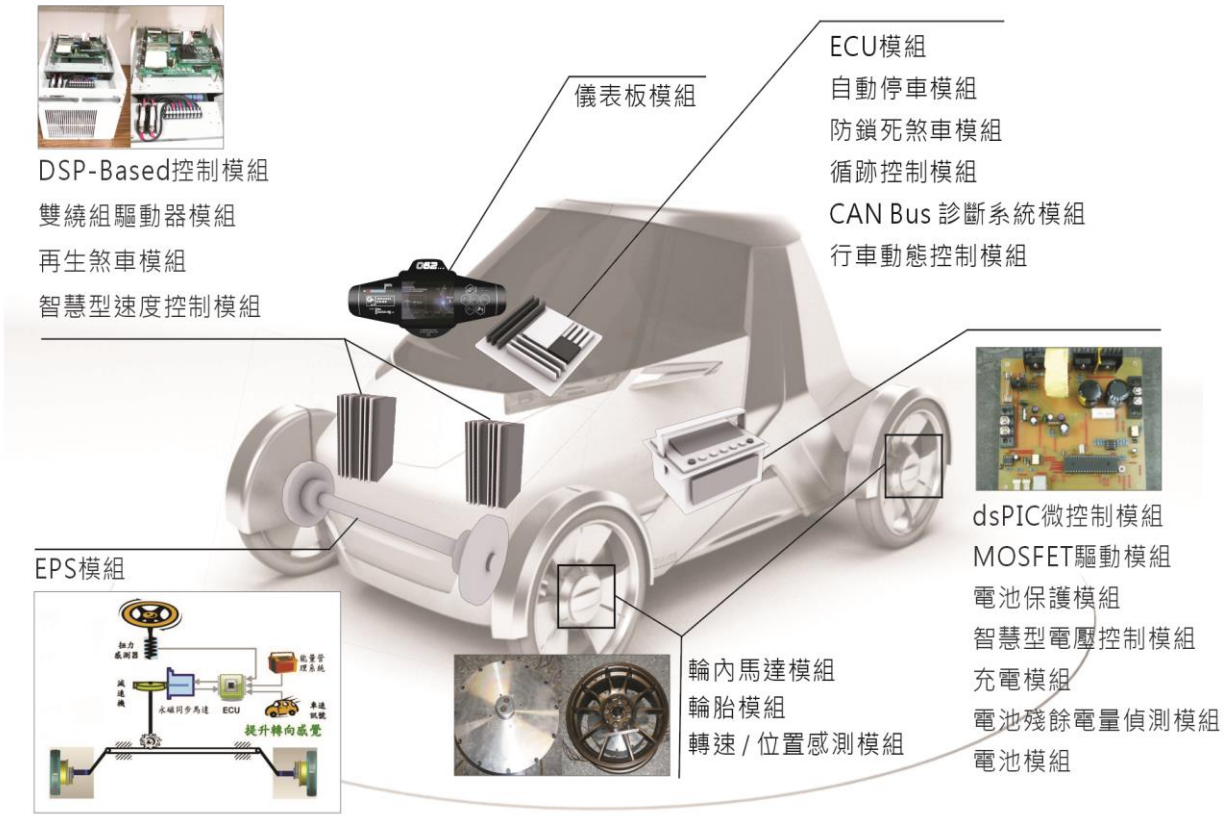
Research Achievements

Sensorless drive system for PMSM compressor using dsPIC



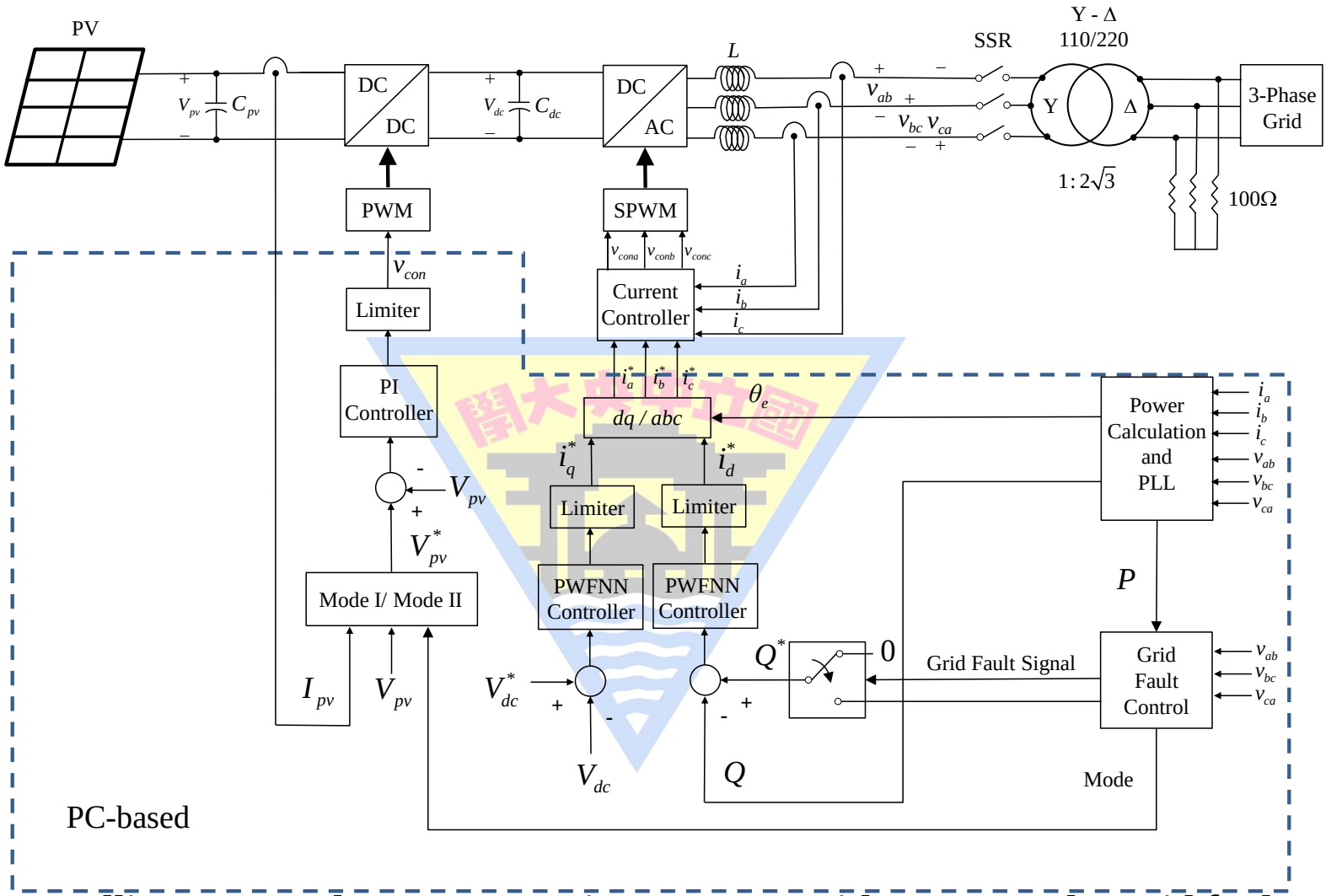
Control block of high frequency signal injection method

Research Achievements



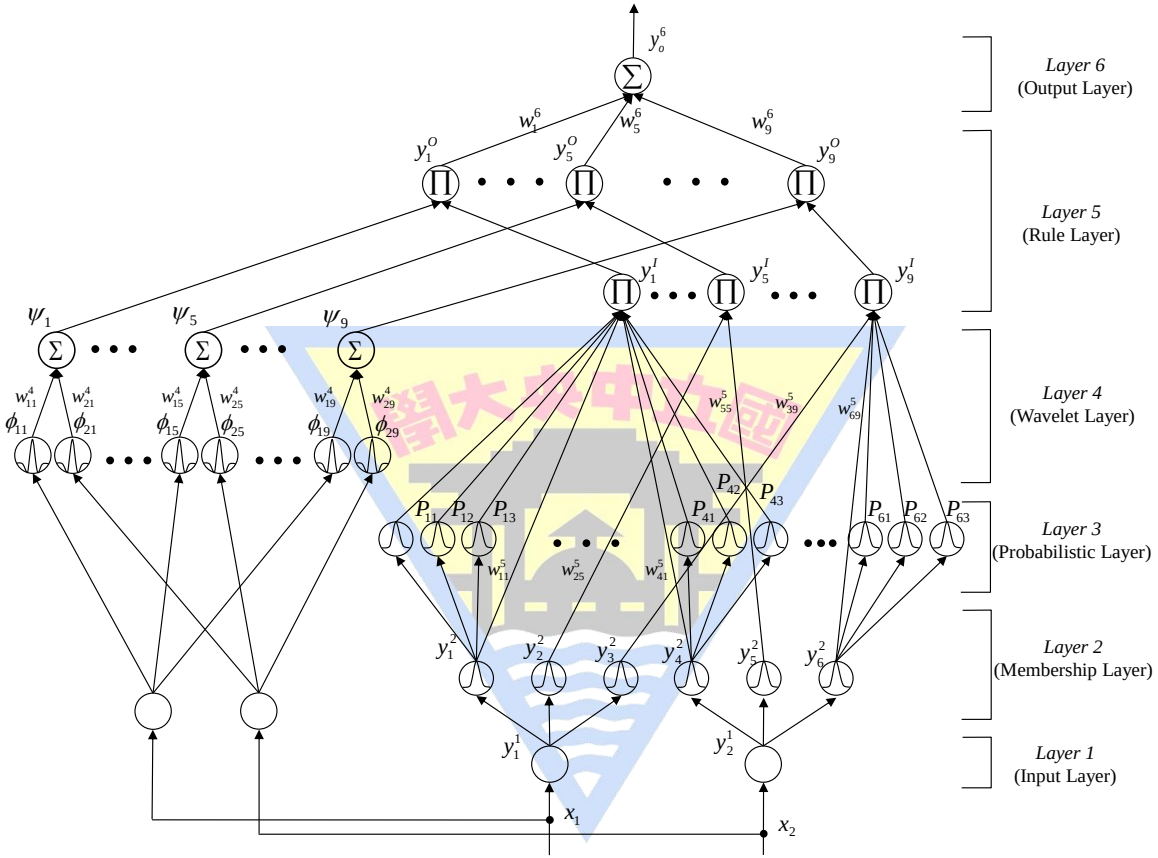
System block of mother-board type intelligent light electric vehicle

Research Achievements



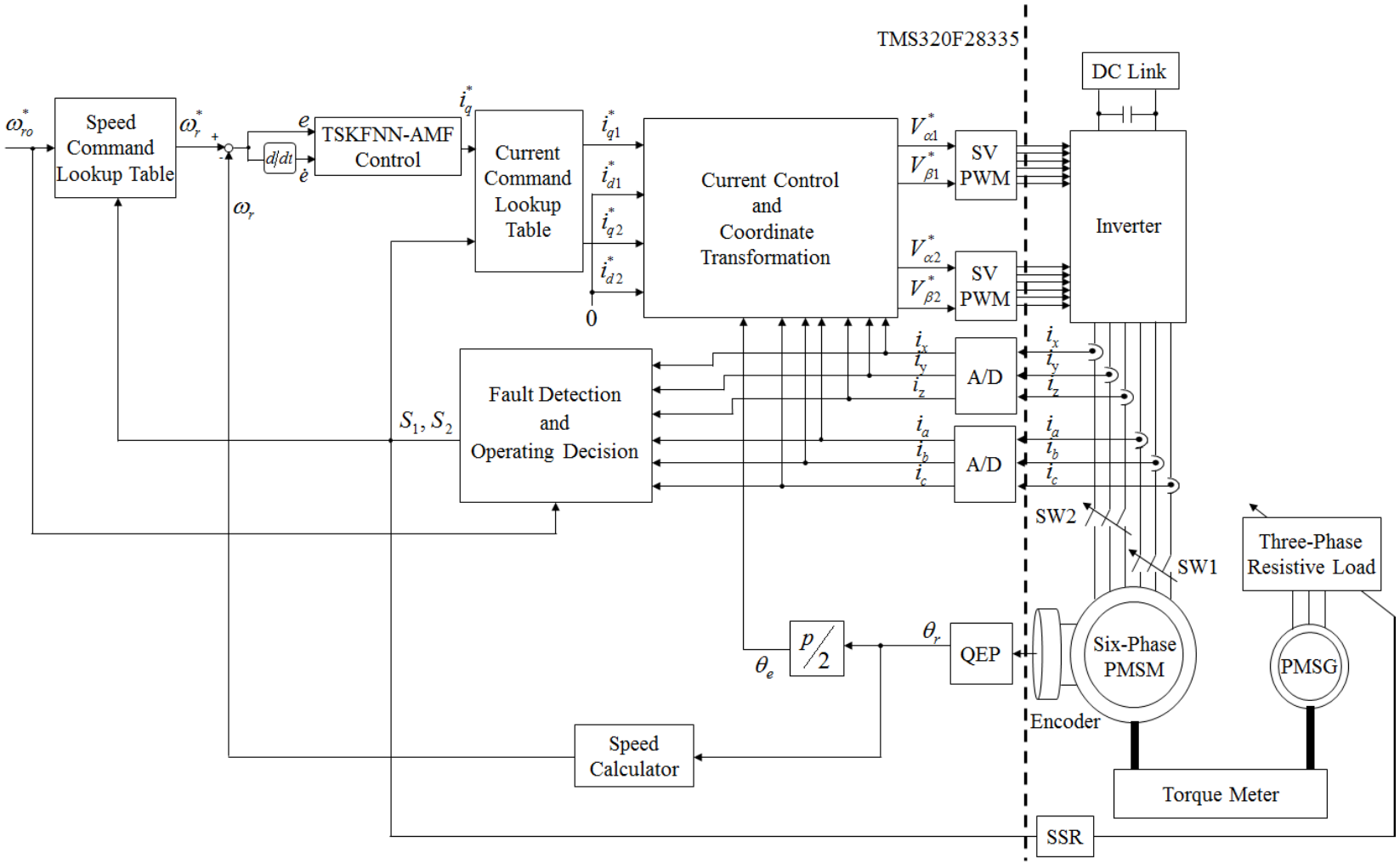
Intelligent control PV system using PWFNN with LVRT under grid fault

Research Achievements



Network structure of probabilistic wavelet fuzzy neural network (PWFNN)

Research Achievements



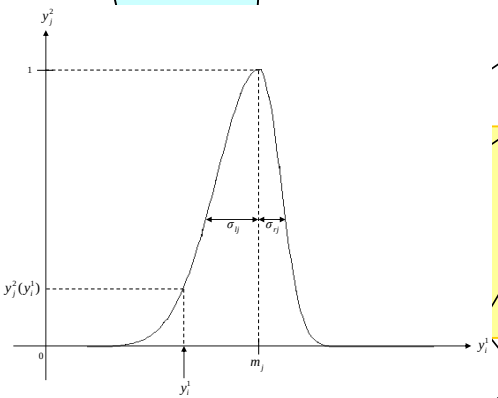
Fault tolerant control led six-phase PMSM drive system using TSKFNN-AMF control

Research Achievements

TSK type FNN with asymmetric membership function

$$net_j^2(N)=\begin{cases}-\dfrac{(y_i^1(N)-m_j)^2}{\sigma_{lj}^{\ 2}}, & -\infty < y_i^1(N) \le m_j \\ -\dfrac{(y_i^1(N)-m_j)^2}{\sigma_{rj}^{\ 2}}, & m_j < y_i^1(N) < \infty\end{cases}$$

$$y_j^2(N)=\exp(net_j^2(N))$$



$$i_q^*=y_o^5$$

$$i_q^*=y_o^5(N)=\sum_k w_k^5(N)y_k^4(N)$$

$$y_k^4(N)=y_k^3(N)T_k(N)$$

$$y_k^3(N)=\prod_j w_{jk}^3 y_j^2$$

$$T_k(N)=\sum_i c_{ik}(N)x_i(N)$$

$$y_i^1(N)=x_i(N)$$

Layer 5
(Output Layer)

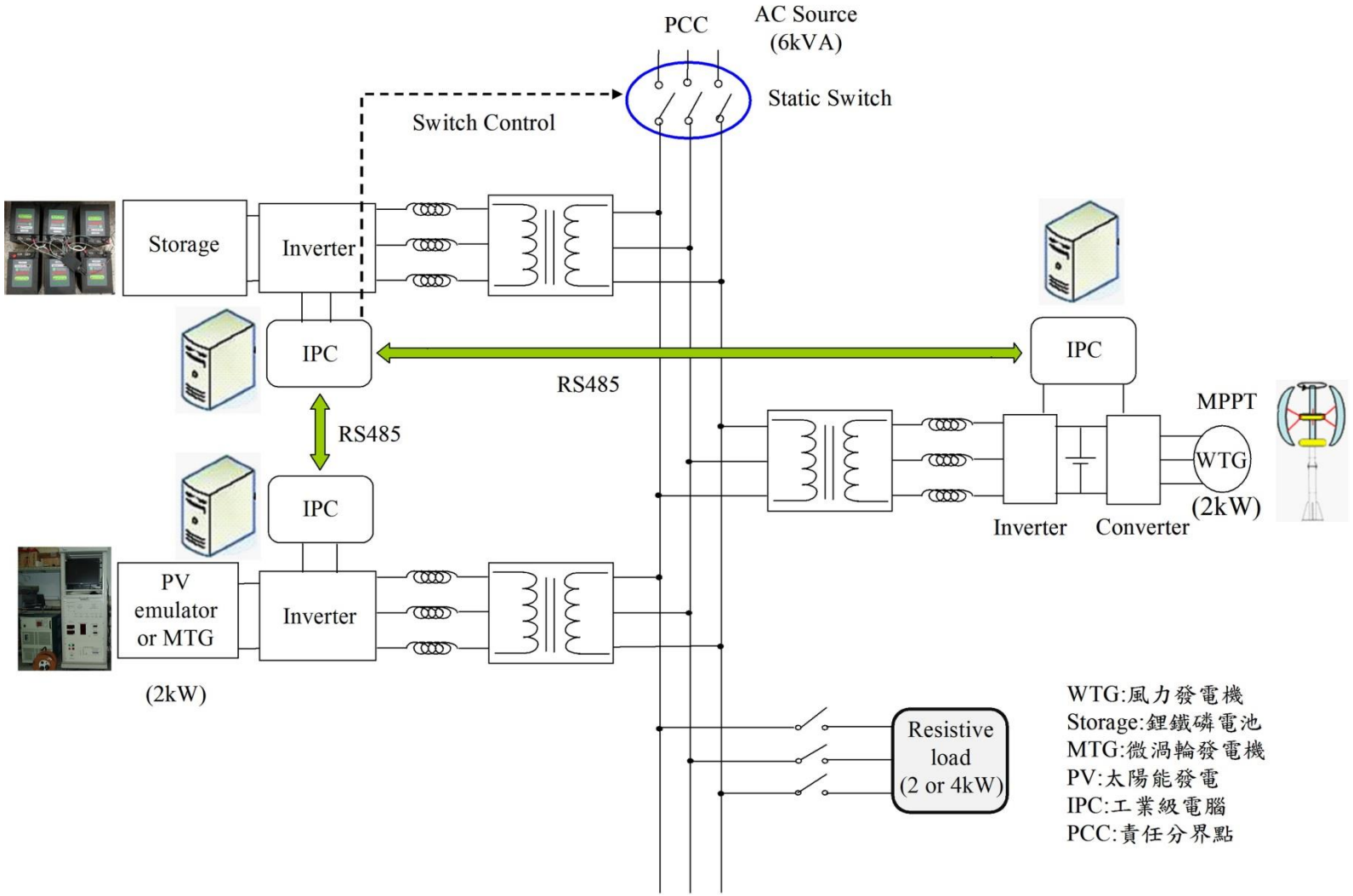
Layer 4
(Consequent Layer)

Layer 3
(Rule Layer and TSK Type Fuzzy Inference Mechanism)

Layer 2
(Membership Layer)

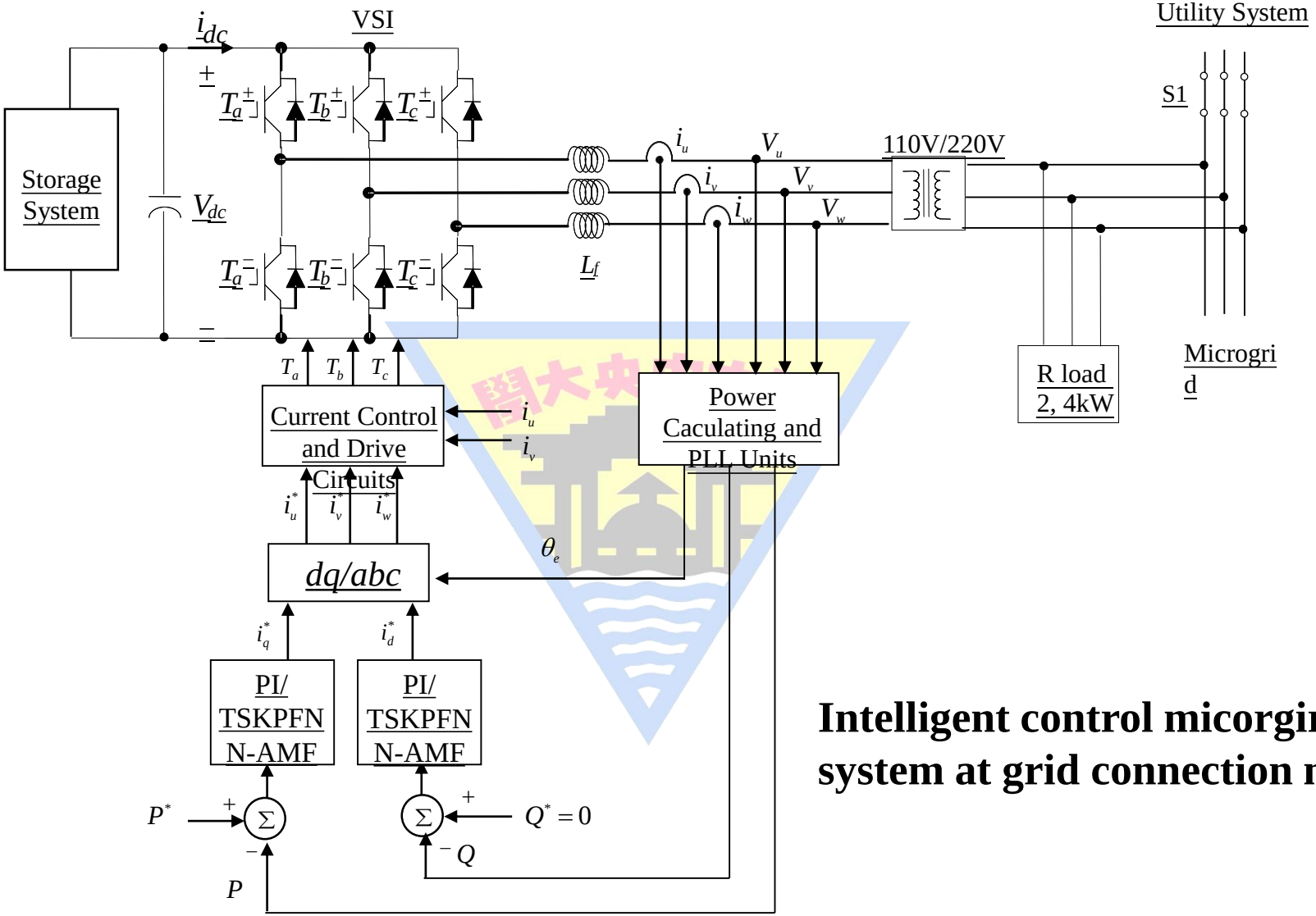
Layer 1
(Input Layer)

Research Achievements



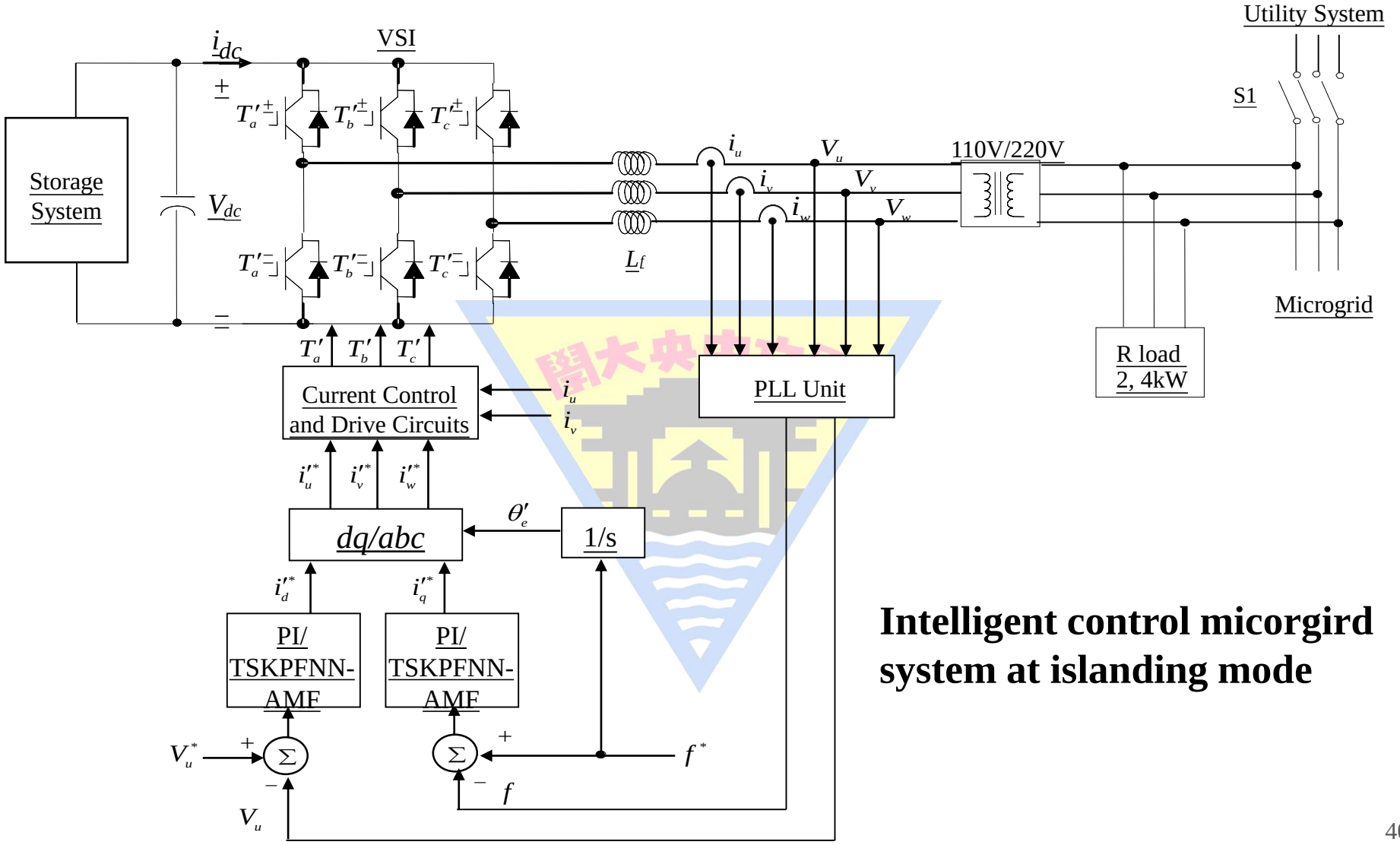
Micorgird system including storage, PV, WTG and islanding detection using intelligent control

Research Achievements



Intelligent control micorgird system at grid connection mode

Research Achievements



Intelligent control micorgird system at islanding mode