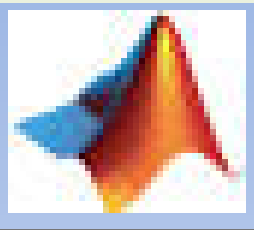
Application of MATLAB in Electrical Engineering

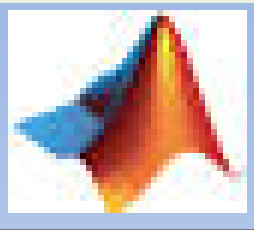
PRESENTED
BY
DR. BHUPENDRA KUMAR

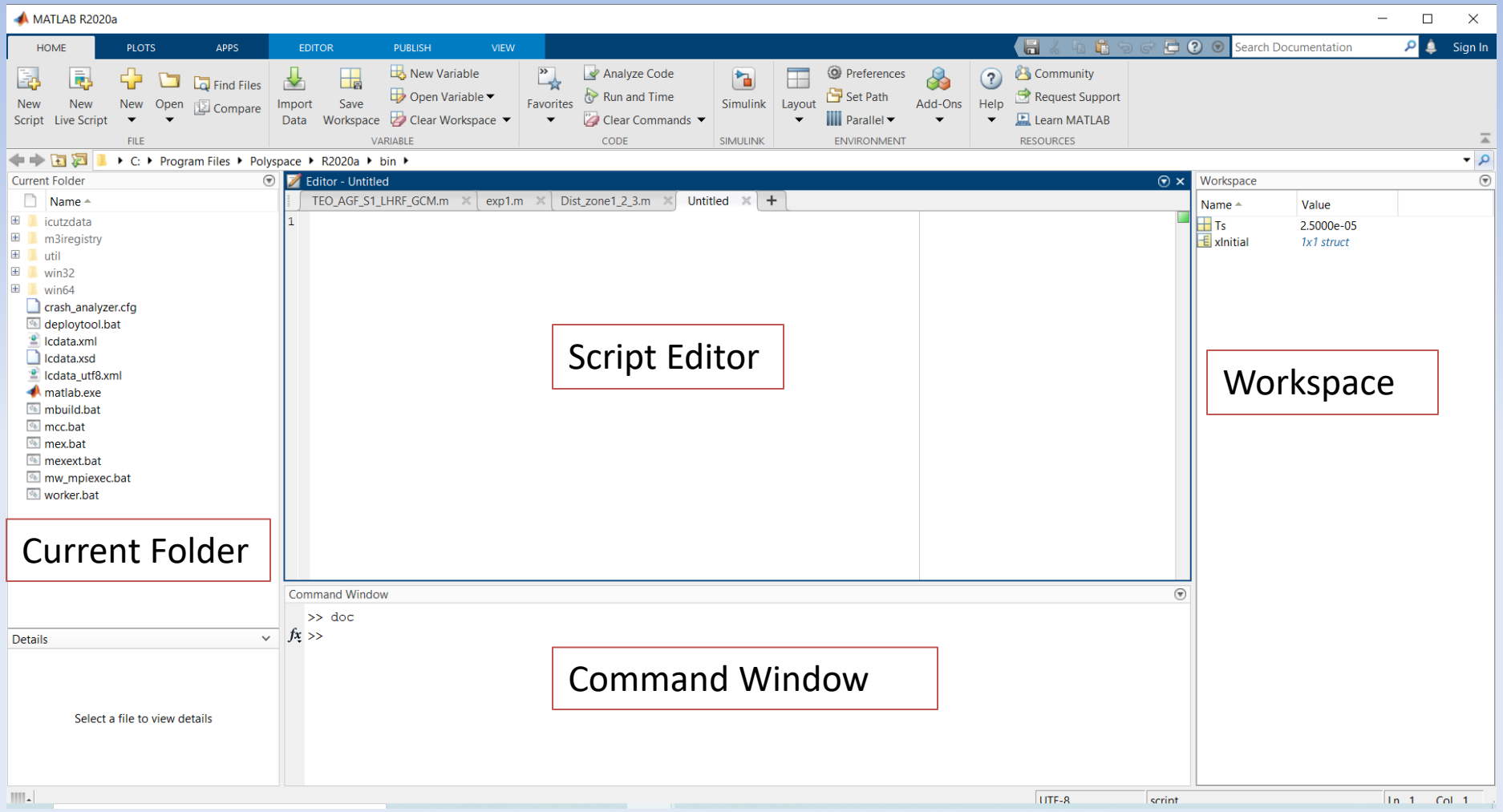
CONTENT

- Introduction to MATLAB Software
- Different Application of MATLAB in Electrical Engineering:
  - As A Calculator
  - Basic Electrical Circuit/Network Theory
  - Electrical Machines
  - Power System Analysis
  - Power Electronics
  - Electric Drives
  - Linear and Non- linear Control System
  - Electric or Hybrid Electric Vehicle
  - Renewable Energy sources
  - Micro-grid
  - Smart Grid
  - Digital Signal Processing
  - Basic/Digital Filtering
  - Etc…….
- Opportunities for skilled MATLAB professional.

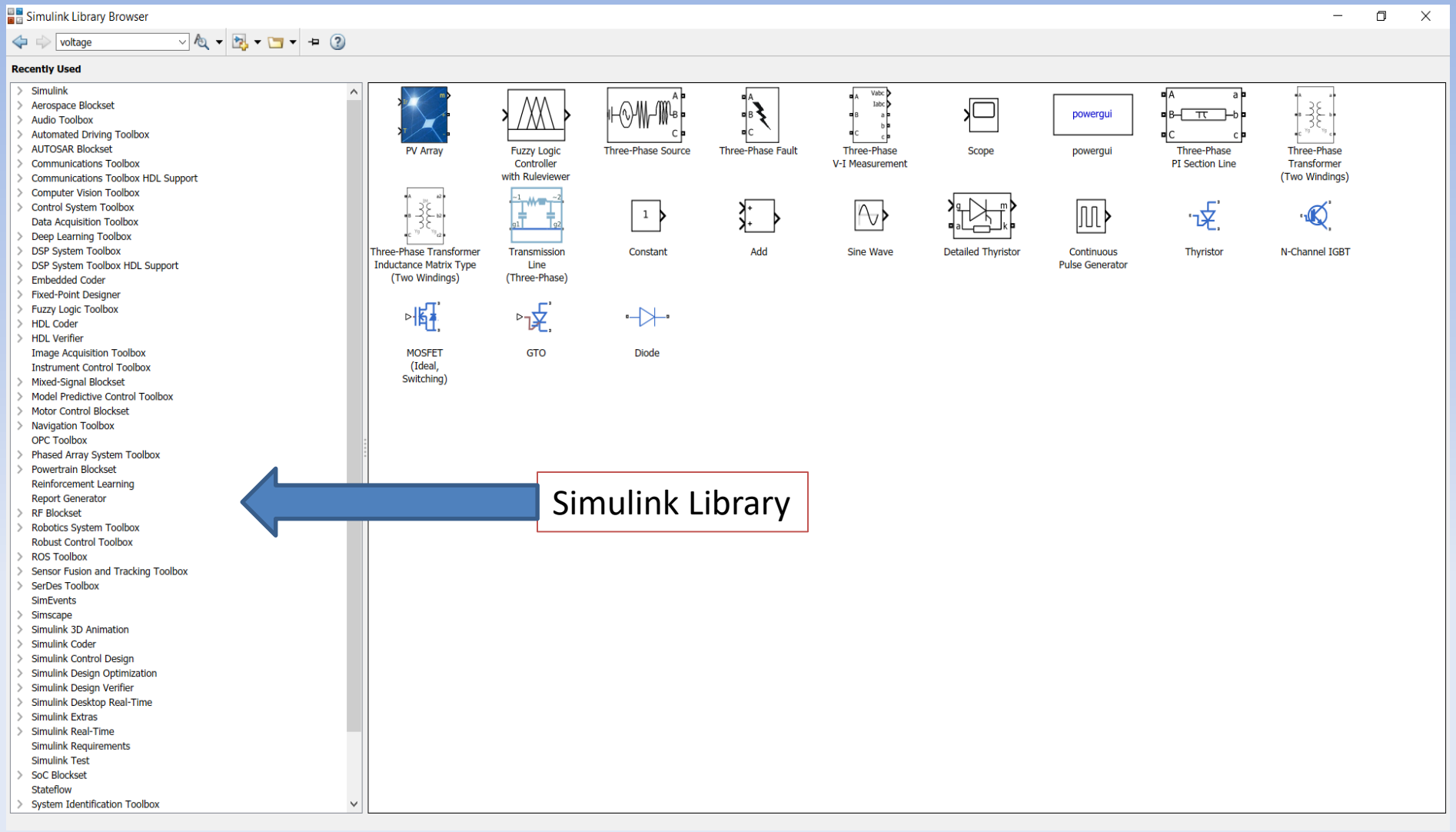
MATLAB SOFTWARE



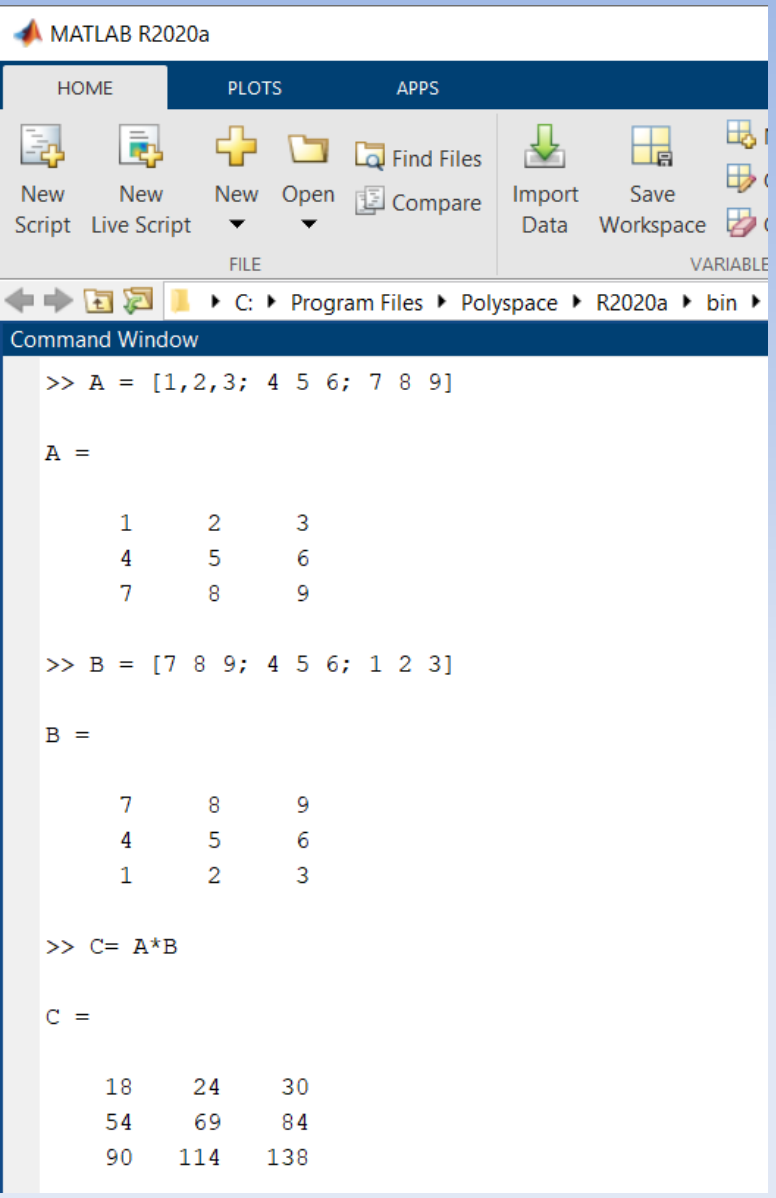


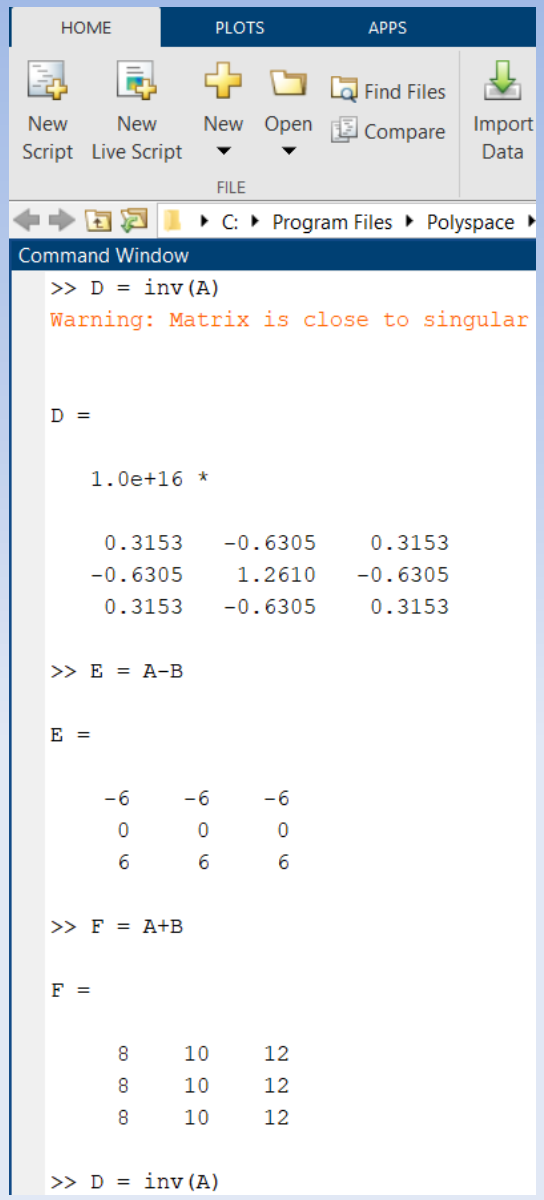


MATLAB SOFTWARE



AS A CALCULATOR





+ addition

- subtraction

***** multiplication

/ right matrix divide

**** left matrix divide

^ power

‘ complex conjugate transpose

.* Element-by-element multiplication.

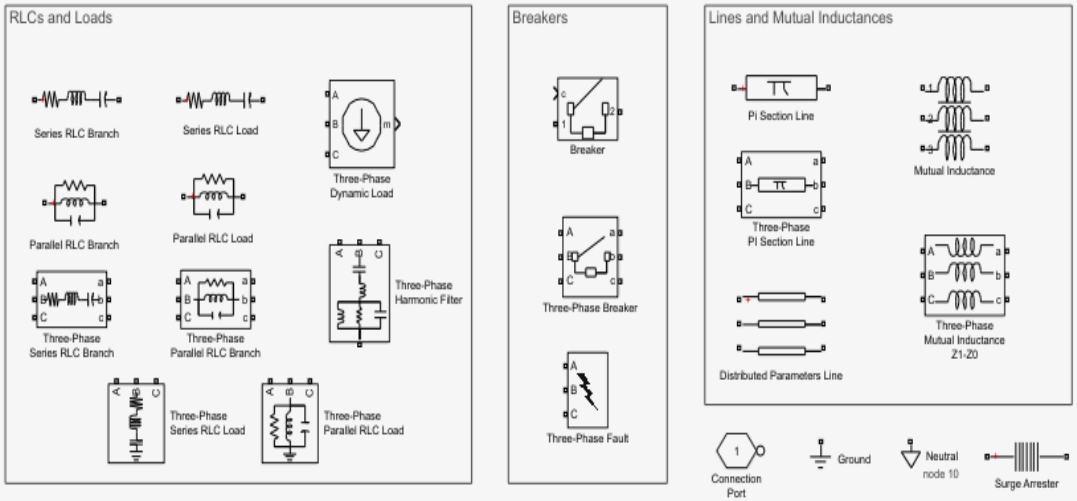
./ Element-by- element Right array div.

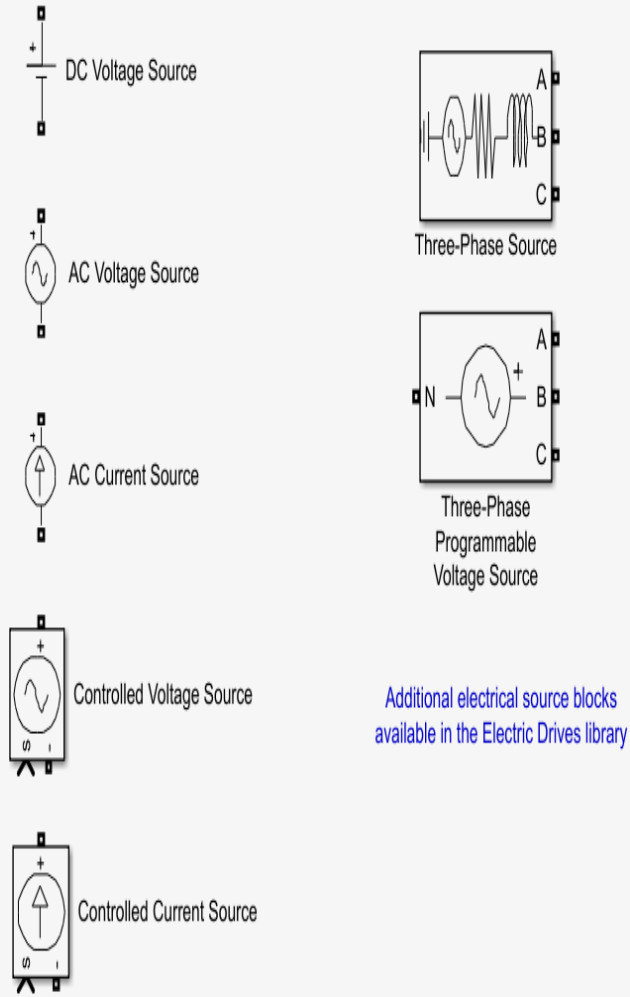
. Left array divide

.^ element-by-element power.

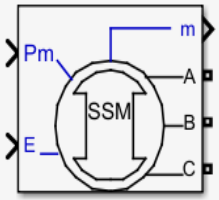
.‘ transpose

BASIC ELECTRICAL CIRCUIT

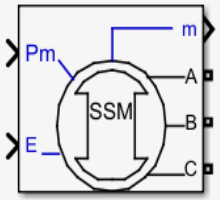




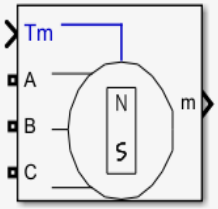
ELECTRICAL MACHINES



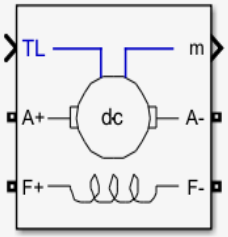
Simplified Synchronous Machine pu Units



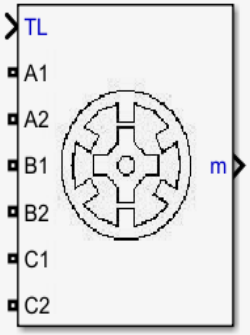
Simplified Synchronous Machine SI Units



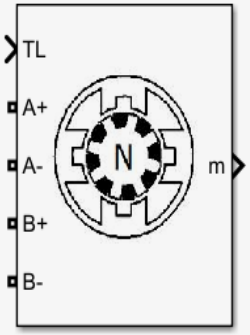
Permanent Magnet Synchronous Machine



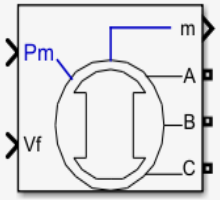
DC Machine



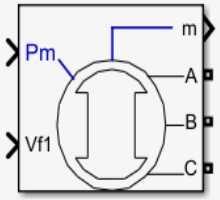
Switched Reluctance Motor



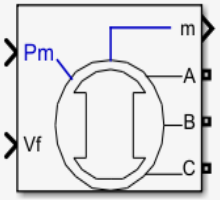
Stepper Motor



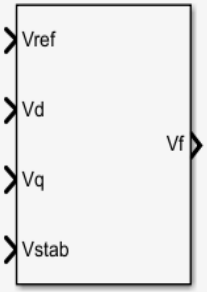
Synchronous Machine pu Fundamental



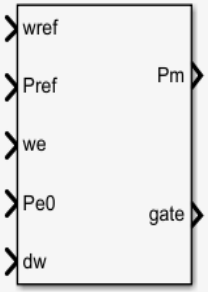
Synchronous Machine pu Standard



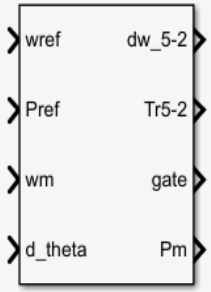
Synchronous Machine SI Fundamental



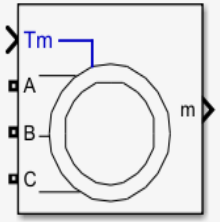
Excitation System



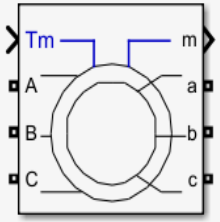
Hydraulic Turbine and Governor



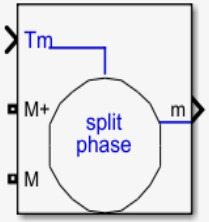
Steam Turbine and Governor



Asynchronous Machine pu Units

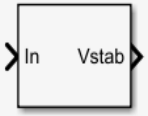


Asynchronous Machine SI Units



Single Phase Asynchronous Machine



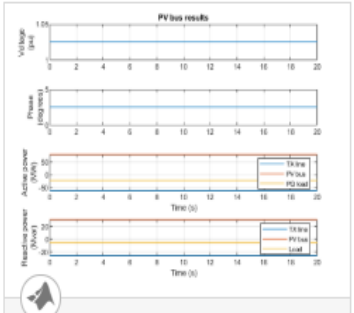


Generic Power System Stabilizer



Multi-Band Power System Stabilizer

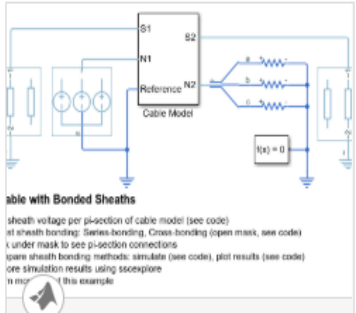
POWER SYSTEM



2-Bus Loadflow

A model of a two-bus three-phase power system network. The model uses three instances of the Load Flow Source block from Simscape™

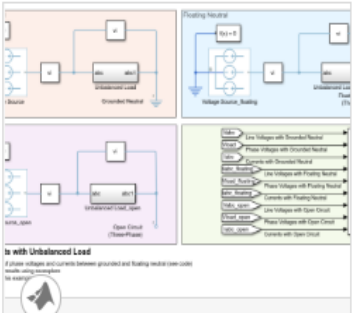
Open Model



AC Cable with Bonded Sheaths

A three-phase cable model comprised of multiple pi-sections. Each phase is enclosed in a conductive sheath. The conductive

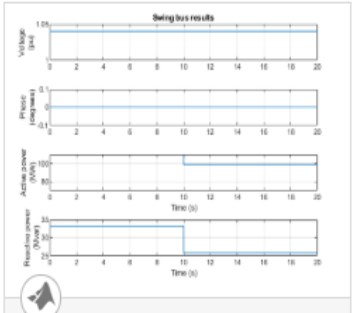
Open Model



Earthing Effects with Unbalanced Load

The effects of three different types of earthing connections on network voltages and currents.

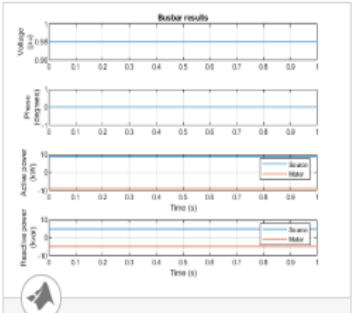
Open Model



IEEE 9-Bus Loadflow

A model of a 9-bus three-phase power system network. This example is based on an IEEE benchmark test case, further details

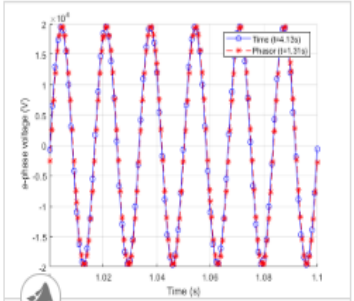
Open Model



Induction Motor Initialization with Loadflow

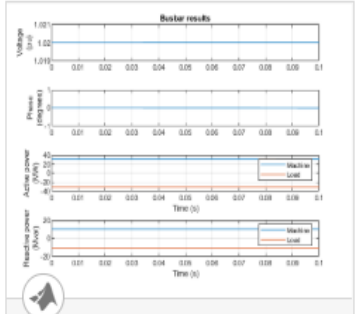
Initialize a three-phase induction motor as part of a load flow analysis. When initializing an induction machine that is directly connected to

Open Model



Phasor-Mode Simulation Using Simscape Components

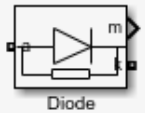
Configure your model to use frequency-time equation formulation



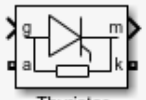
Synchronous Machine Initialization with Loadflow

Initialize synchronous machine as part of a load flow analysis. When

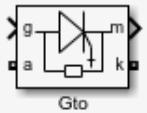
POWER ELECTRONICS



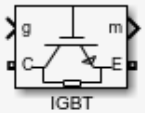
Diode



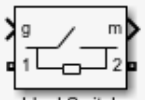
Thyristor



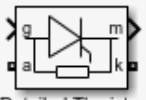
Gto



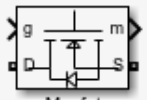
IGBT



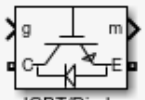
Ideal Switch



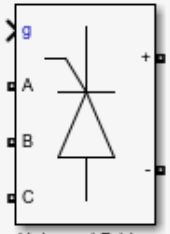
Detailed Thyristor



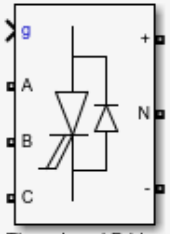
Mosfet



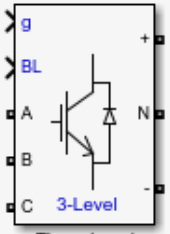
IGBT/Diode



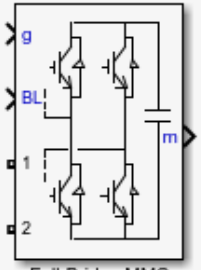
Universal Bridge



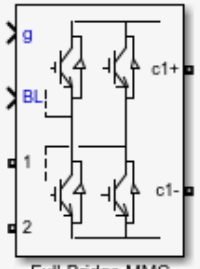
Three-Level Bridge



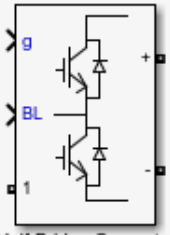
Three-Level
NPC Converter



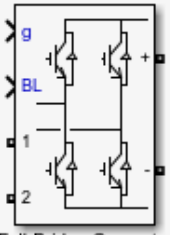
Full-Bridge MMC



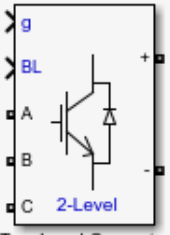
Full-Bridge MMC
(External DC Links)



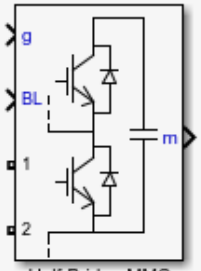
Half-Bridge Converter



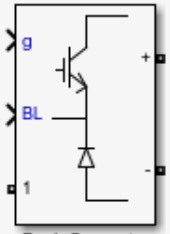
Full-Bridge Converter



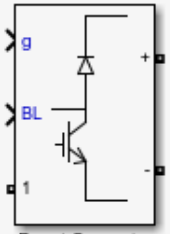
Two-Level Converter



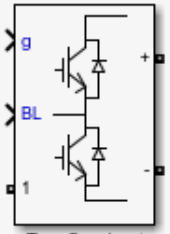
Half-Bridge MMC



Buck Converter

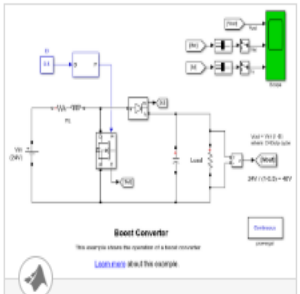


Boost Converter



Two-Quadrant
DC/DC Converter

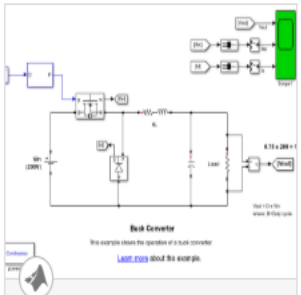
POWER ELECTRONICS



Boost Converter

The operation of a boost converter.

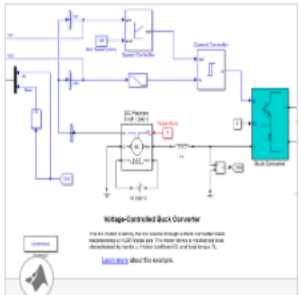
Open Model



Buck Converter

The operation of a buck converter.

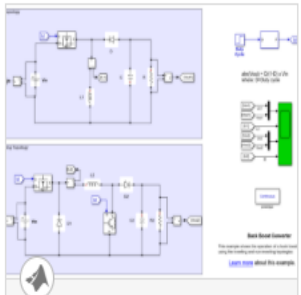
Open Model



Voltage-Controlled Buck Converter

The operation of a voltage-controlled buck converter.

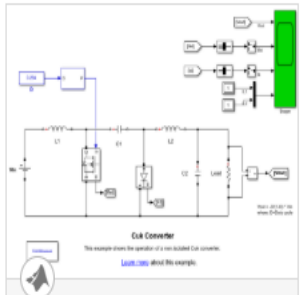
Open Model



Buck Boost Converter

The operation of buck boost converters using the inverting and non-inverting topologies.

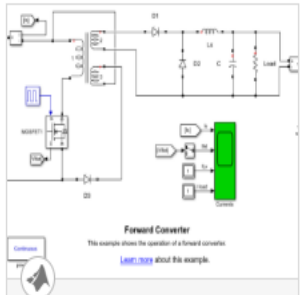
Open Model



Cuk Converter

The operation of a non-isolated Cuk converter.

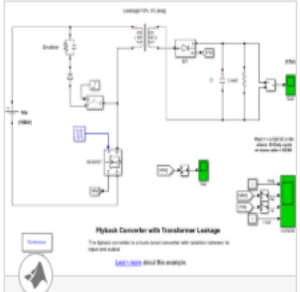
Open Model



Forward Converter

The operation of a forward converter.

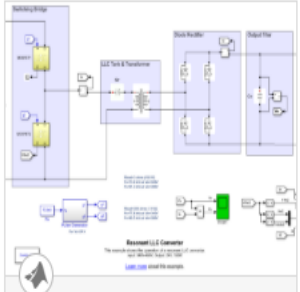
Open Model



Flyback Converter with Transformer Leakage

The operation of a flyback converter.

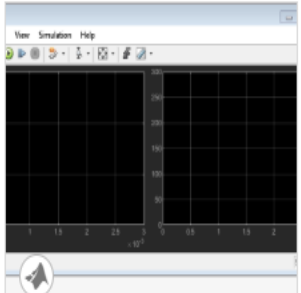
Open Model



Resonant LLC Converter

The operation of a resonant LLC converter.

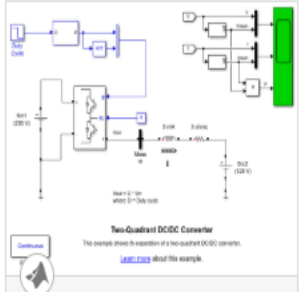
Open Model



Series Load Resonant (SLR) Converter

The operation of a series load resonant converter.

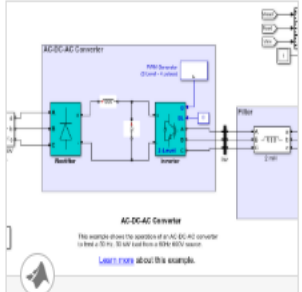
Open Model



Two-Quadrant DC/DC Converter

The operation of a two-quadrant DC/DC converter.

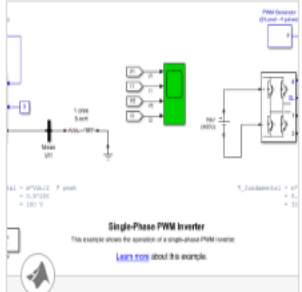
Open Model



AC-DC-AC Converter

The operation of an AC-DC-AC converter.

Open Model

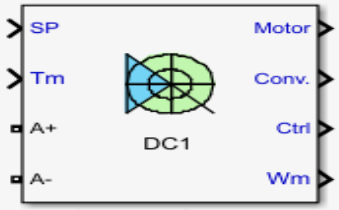


Single-Phase PWM Inverter

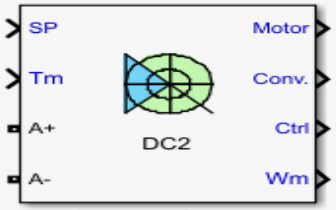
The operation of a single-phase PWM inverter.

Open Model

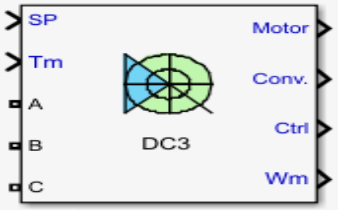
ELECTRIC DRIVES



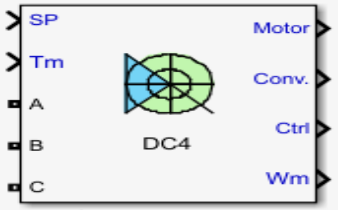
Two-Quadrant Single-Phase Rectifier DC Drive



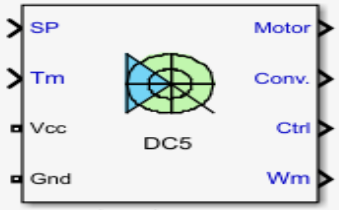
Four-Quadrant Single-Phase Rectifier DC Drive



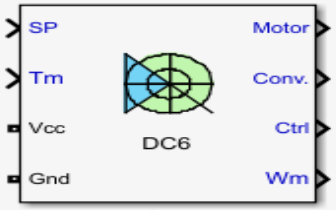
Two-Quadrant Three-Phase Rectifier DC Drive



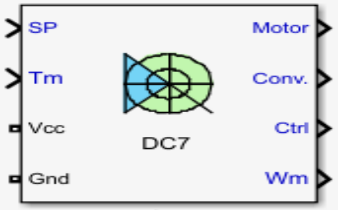
Four-Quadrant Three-Phase Rectifier DC Drive



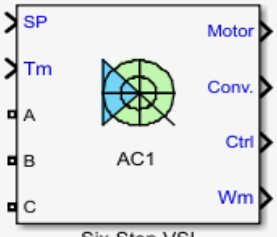
One-Quadrant Chopper DC Drive



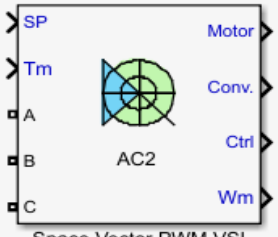
Two-Quadrant Chopper DC Drive



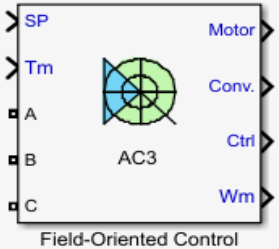
Four-Quadrant Chopper DC Drive



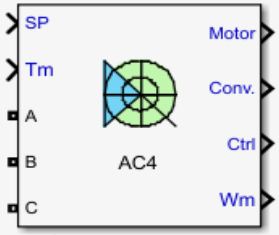
Six-Step VSI Induction Motor Drive



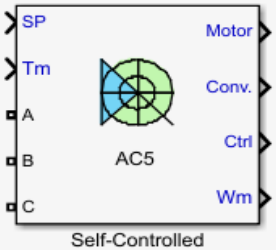
Space Vector PWM VSI Induction Motor Drive



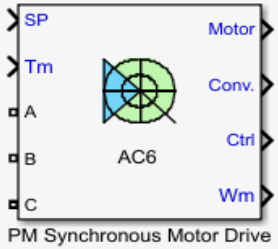
Field-Oriented Control Induction Motor Drive



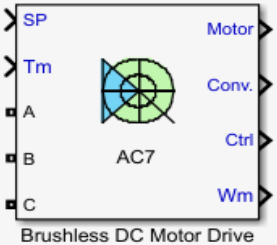
DTC Induction Motor Drive



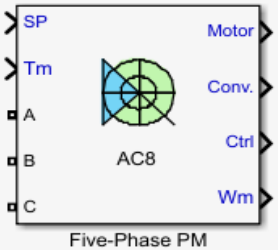
Self-Controlled Synchronous Motor Drive



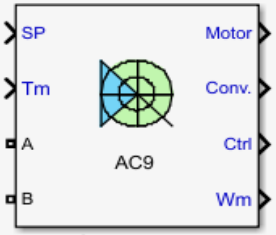
PM Synchronous Motor Drive



Brushless DC Motor Drive

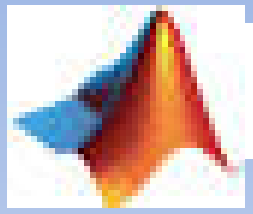


Five-Phase PM Synchronous Motor Drive



Single-Phase Induction Motor Drive

OPPORTUNITIES



MathWorks
Bengaluru, Karnataka



Microchip Technology Inc.
Bengaluru, Karnataka

Principal Matlab Simulink Applications Engineer

MAXWELL ENERGY SYSTEMS PRIVATE LIMITED
India

Battery Modeling Engineer

ELMAX Systems and Solutions
India

SGP R&D India Pvt Ltd
Bengaluru, Karnataka



Zf Friedrich
Uttar Pradesh
Electric Drive Simulation



Alois Staffing
Chennai, Tamil Nadu



Stellantis
Hyderabad, Telangana
Soft & Virtual ECU Engineer- Matlab Testing



Satyam Venture Engineering Services
Hyderabad, Telangana