AMRITA
VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY UNDER SECTION 3 OF UGC ACT, 1956

GROUP – 12

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TITLE:

Photovoltaic supplied dc motor fed from dc-dc converter and controlled by neural networks

INTRODUCTION

FOR THE PV PANELS AND DC – DC CONVERTORS

INTRODUCTION:

A photovoltaic panel converts sunlight into electrical energy using the photovoltaic effect, generating direct current (DC) electricity based on sunlight intensity and panel characteristics.

The output current and voltage are influenced by environmental factors such as temperature and solar radiation, calculated using standard equations involving series and shunt resistance.

A quadratic boost converter increases the DC voltage from the PV panel using two inductors and two capacitors, achieving a higher boost ratio than a conventional boost converter.

Maximum Power Point Tracking (MPPT) ensures the PV panel generates maximum power. An RBF (Radial Basis Function) neural network predicts the optimal duty cycle for MPPT, controlling the quadratic boost converter.

The simulation includes PV power calculation, boost converter output voltage control using the Euler method, and RBF neural network training for accurate power extraction

Objectives:

1.Maximize Power Output:
Optimize the PV panel output by adjusting the MPPT algorithm dynamically.

2.Implement Quadratic Boost Converter:
Design and simulate a quadratic boost converter to increase output voltage efficiently.

3.Enhance System Efficiency:
Reduce losses and increase overall system performance through optimal parameter tuning.

4.Develop Intelligent MPPT Using RBF Neural Network:
Use an RBF-based neural network to improve real-time tracking of maximum power point.

5.Ensure System Stability Under Load Variations:
Design control strategies to maintain stable output under varying load conditions.

6.Simulate Real-World Operating Conditions:
Test the system under various solar irradiance and temperature conditions.

7.Minimize Computational Complexity:
Optimize neural network architecture and control loops to reduce processing time.

METHODOLOGY:

1.PV Panel Modeling: Define PV panel parameters including short circuit current, open circuit voltage, series resistance, shunt resistance, and reverse saturation current. Model the current-voltage (I-V) characteristics using the shunt resistance, and reverse saturation current. Model the current-voltage (I-V) characteristics using the diode equation

2.Power Calculation: Compute PV output power using the relation: $P_{pv} = V_{pv} \times I_{pv}$ Plot the I-V and P-V characteristics to visualize the operating behavior of the PV panel

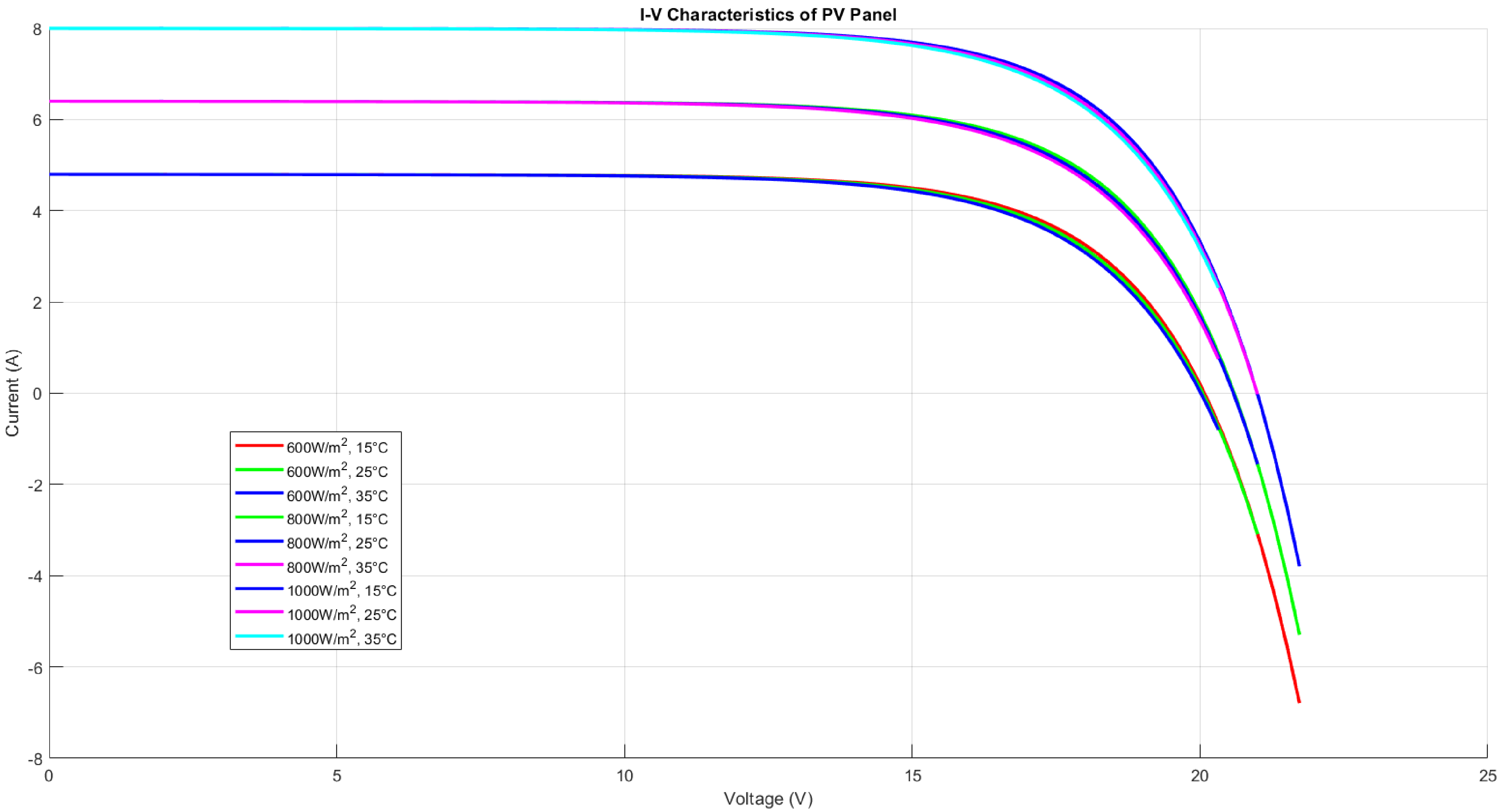
3.Quadratic Boost Converter Design: Define converter parameters including inductance (L1, L2), capacitance (C1, C2), load resistance, and switching frequency. Initialize state variables for inductor currents and capacitor voltages. Apply switching logic using the Euler method to update system states at each time step. Control the duty cycle to regulate the output voltage

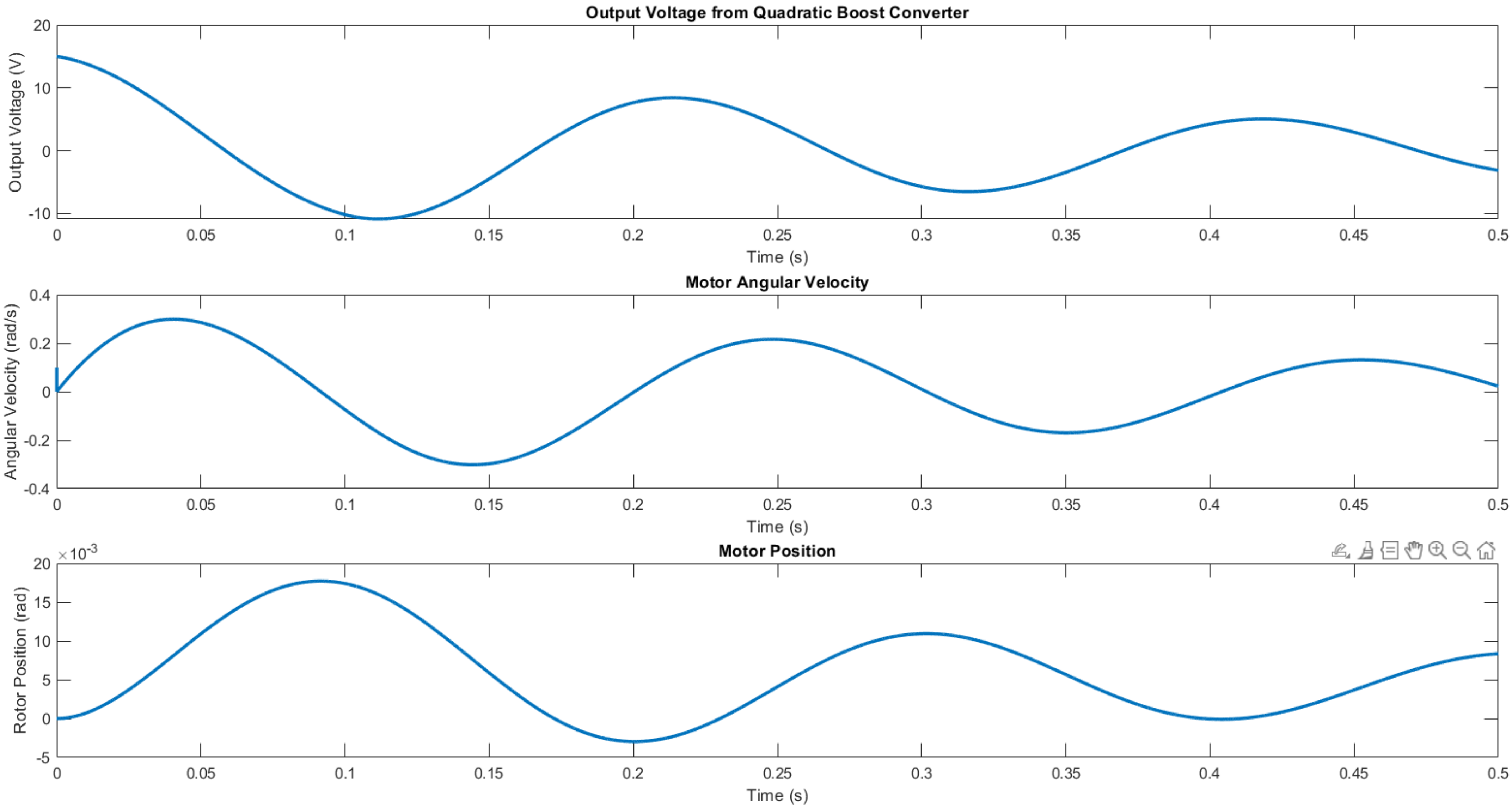
- **4.Maximum Power Point Tracking (MPPT) Using RBF Neural Network:** Train an RBF neural network with PV voltage and current as input, and normalized power as output. Use newrb to create and train the network with defined spread factor and number of hidden neurons. Simulate the trained network to predict the optimal duty cycle for maximum power output.
- **5.Simulation and Analysis:** Simulate the PV panel and converter system under varying sunlight and load conditions. Analyze plots of I-V characteristics, P-V characteristics, and output voltage over time. Evaluate system efficiency and MPPT tracking accuracy.

FUTURE SCOPE

1.Integration with Simulink Model:
Combine MATLAB code with Simulink for real-time system simulation.
2.Real-Time MPPT Enhancement:
Improve MPPT performance with adaptive learning techniques.
3.Hardware Implementation:
Extend the system to a microcontroller-based hardware setup.
4.Hybrid Energy Systems:
Integrate solar with wind and battery storage for hybrid operation.
5.Enhanced Stability and Efficiency:
Further optimize inductor and capacitor values to reduce power loss.

RESULTS OF MATLAB CODE:




Output Voltage from Quadratic Boost Converter
Output Voltage (V)
20
10
0
-10
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Time (s)
Motor Angular Velocity
Angular Velocity (rad/s)
0.4
0.2
0
-0.2
-0.4
Time (s)
Motor Position
×10^-3
Rotor Position (rad)
20
15
10
5
0
-5
Time (s)

THANK YOU