Assignment submission for MATLAB/Simulink Intern Position

Objective : To design a MATLAB/Simulink model of a basic solar inverter system and analyze its performance under varying conditions.

Solar Panel Modeling:

In the assignment, it was given to model a solar panel under standard conditions (1000W/m^2, 25°C), but for, Ir = 1000W/m^2, the model was showing error (as shown below in figure). Therefore, I have done the modeling for Ir = 500W/m^2, the model and result for the same is shown below:

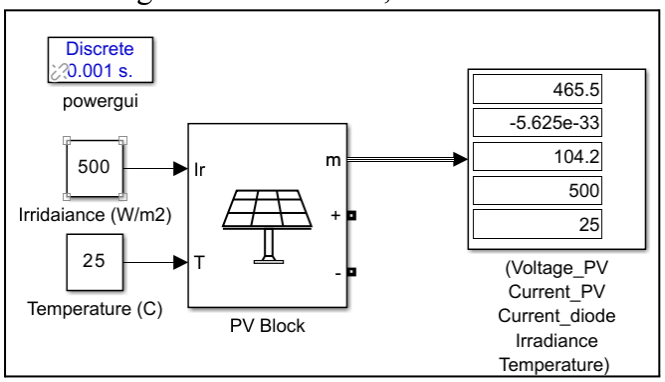


Fig 1 : solar panel model

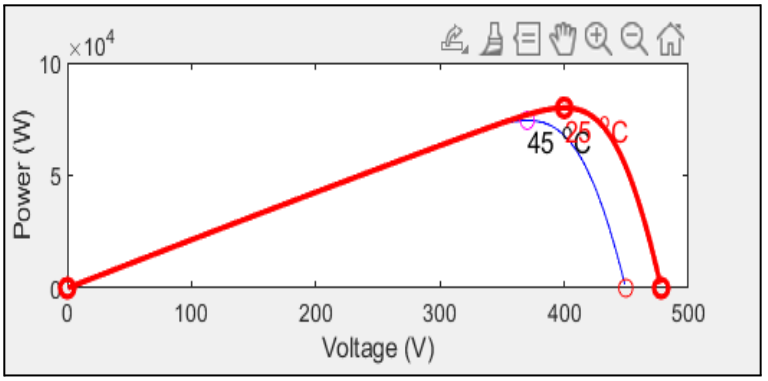
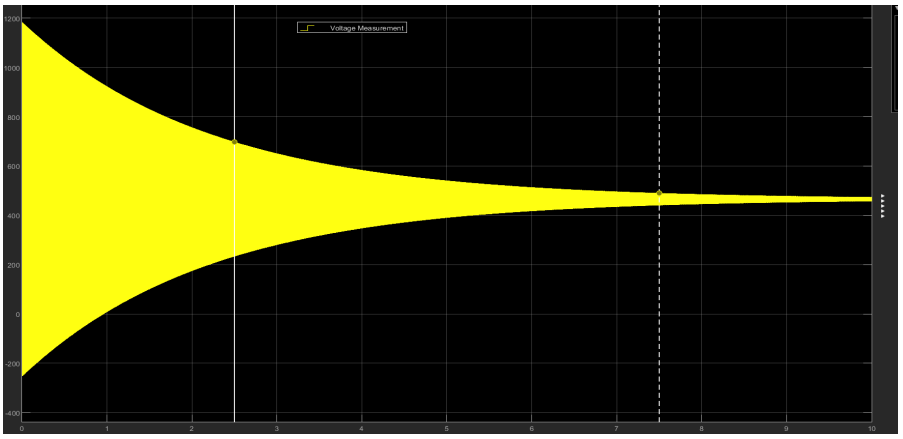


Fig 2 : characteristic of photovoltaic cell used

The DC voltage output from the solar panel model is V = 465.5**V**, hence from the characteristic curve of Power vs Voltage of the photovoltaic cell at V = 465.5**V**, we can see that the power is around 500-700**W** maximum.

Result :



The voltage initially is ranging from +1200, -400, after which it sets to a DC voltage of around 465V (as obtained above).

Fig 3 : Voltage variation

Error that I faced during simulation:

An error occurred while running the simulation and the simulation was terminated

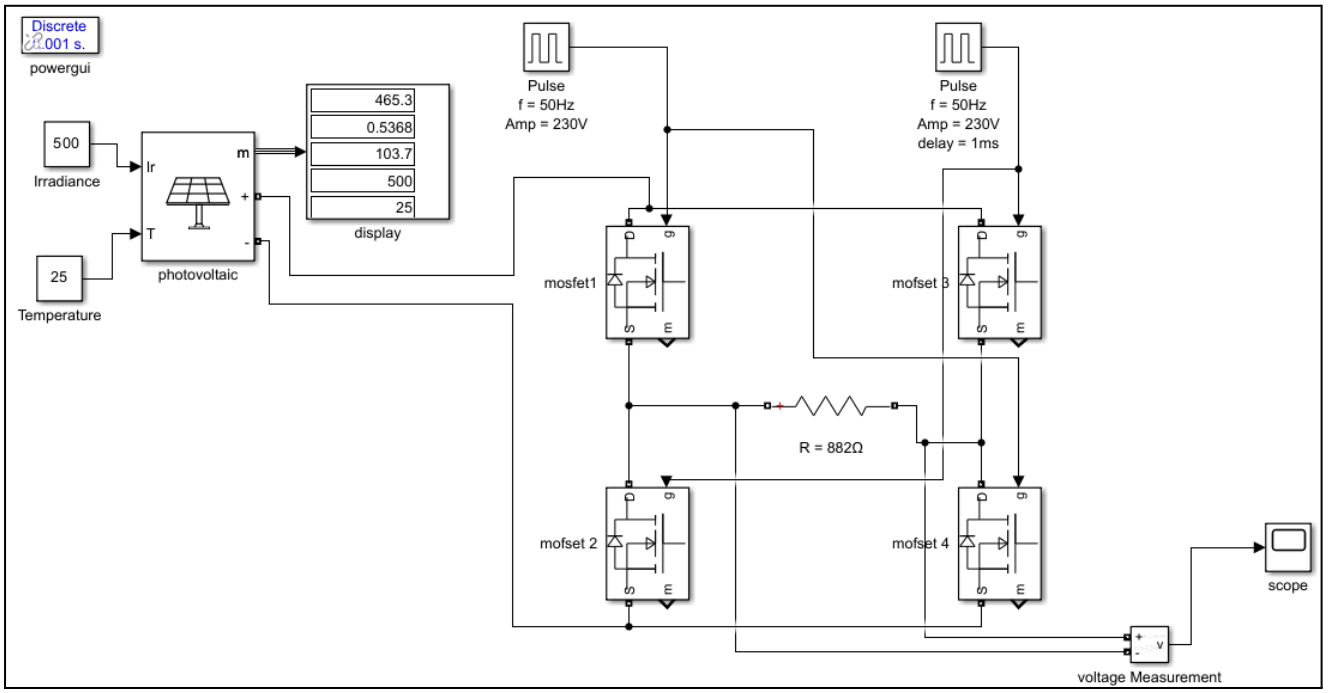
Caused by:

- Algebraic state in algebraic loop containing 'photovoltaic/PV Block/Diode Rsh/Product5' computed at time 0.0 is Inf or NaN. There may be a singularity in the solution. If the model is correct, try reducing the step size (either by reducing the fixed step size or by tightening the error tolerances) or tweak the initial guess of algebraic loop variable values.

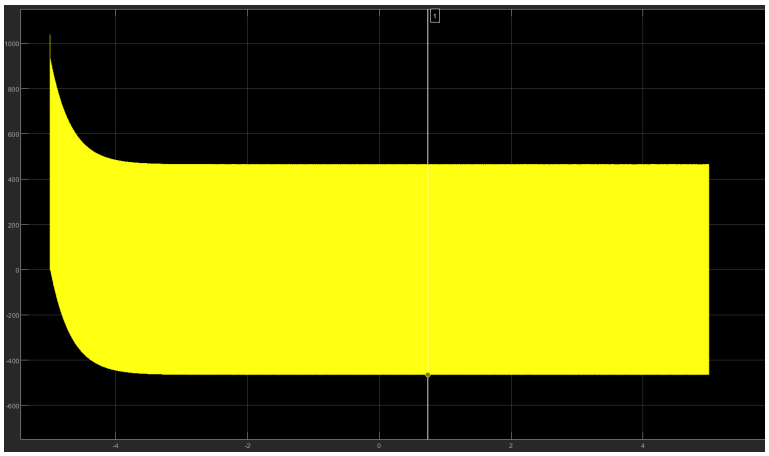
Component: Simulink | Category: Block error

Inverter & Load Modeling

The inverter is designed for a single-phase, 230V, 50Hz system. The model is in continuation of the above solar panel with input voltage as 465.5V, which was the output from the above solar panel. The model is shown below:



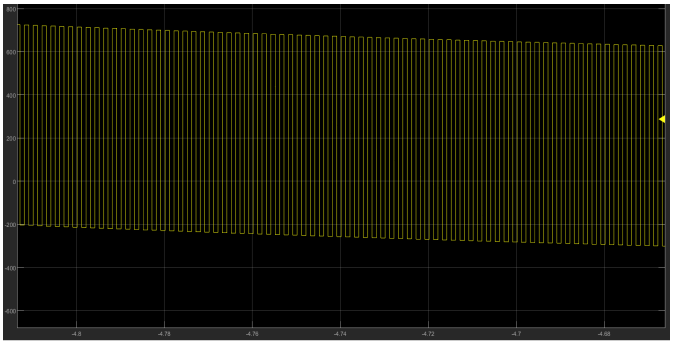
Result :



The Voltage is starting from around +1300, 0 to maintain a constant AC voltage of peak around +420V, for a generated pulse of +230V, 50Hz. The close looks of the waveforms are shown below :

Fig 4 : DC voltage variation

Closed look of waveforms obtained:



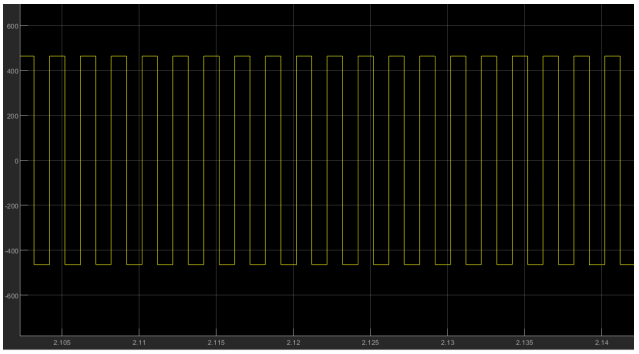


Fig 5 : waveforms of AC voltages having 50Hz frequency

Simulation

After varying irradiance, for some irradiance values (e.g. 400, 750, 800 etc.) the model was showing error. While for some irradiance values like Ir = 300, 550 The result was almost the same as the figure shown above.

Link for Simulink files : https://github.com/Vish-2003/solar_inverter_assignment.git