Department of Electrical Engineering
Assignment
Date: 23/06/2020

Course Details

Course Title: Power Electronics **Module:** 4rth
Instructor: **ENGR, AMIR AAMAN** **Total Marks:** 50

Student Details

Name: **AZHAD NIAZ** **Student ID:** **15493**

Q1.	The solar energy is low density energy so it is perfect to be installed in urban and suburban areas. In this way the zero energy building goal can be reached but many other problems arise for the real integration. What is your opinion that the future of photovoltaic, solar thermal and hybrid PV/T systems is in the building integration?	Marks 10 CLO 1
Q2.	What is the technical difference between grid forming and grid supporting inverters? Back your answer with valid data, facts and figures.	Marks 10 CLO 1
Q3.	Electric cars and hydrogen cars both run on apparently clean fuels. However, the source of electricity or hydrogen production may be based over partially clean processes. It is a question of the future, which of them will prevail.	Marks 10 CLO 2
Q4.	Is it possible to control speed using Boost Converter? Give your answer with proper example.	Marks 10 CLO 2
Q5.	Describe the effect on distortion on the output frequency of the cycloconverter? Back your answer with valid data, facts and figures.	Marks 10 CLO 2

****

☺GOOD LUCK☺

Student Details

Name: AZAHD NIAZ **Student ID:** 15493

Q1 The solar energy is low density energy so it is perfect to be installed in urban and suburban areas. In this way the zero energy building goal can be reached but many other problems arise for the real integration.
What is your opinion that the future of photovoltaic, solar thermal and hybrid PV/T systems is in the building integration?

ANS:

In my opinion, the future use of solar power is for the generation of electricity because this type of energy source is one of the component of the so-called "renewable energy sources". In addition, solar photovoltaic has an important role to play in building integration and many countries from all regions have been developing this new form of using solar photovoltaic.
It has been estimated, that within the EU the renewable energy sources share in electricity sector would be around 35 % in 2020, if the 20 % target for renewable energy sources is achieved. In the EU, renewable accounted for almost 70 % of additions to electric capacity in 2012, mostly from solar photovoltaic and wind power. In 2011, renewable met 20.6 % of the region's electricity consumption and 13.4 % of gross final energy consumption. Renewable made up just over half of total net additions to electric generating capacity from all sources in 2012. By year's end, they comprised more than 26 % of global generating capacity and supplied an estimated 21.7 % of global electricity, with 16.5 % of electricity provided by hydropower. Industrial, commercial, and residential consumers are increasingly becoming producers of renewable power in a growing number of countries

Solar thermal and hybrid just seem to have an increasingly tough time hitting their paybacks for large installations, not because either of those are deficient, but because the juggernaut of PV has rolled so strong and so hard through the building technologies sector. PV keeps making it harder for everything else to compete.
My approach on this is to assume that the human cost is inevitably the expensive one ... mistakes cost more than high technology, training is expensive, people rotate through jobs, they call in sick, and they vary the way they interact with systems.

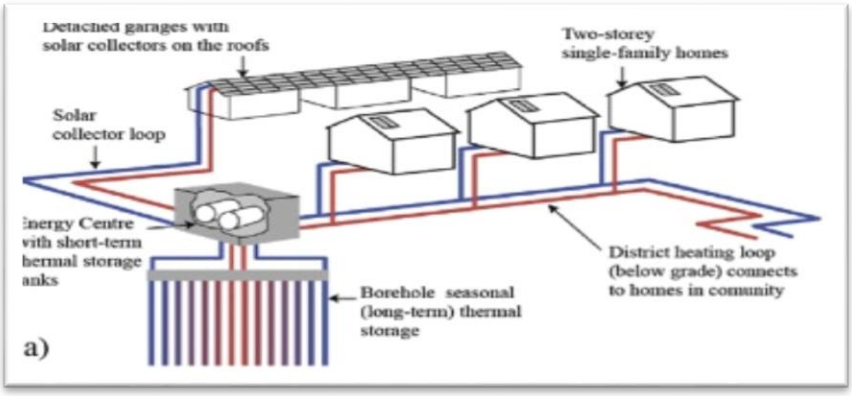
I think there is a good future for passive solar heating and energy storage, especially when combined with heat pumps, but the trick with those is to use simplicity as a design feature.
The problems you mention about integration with PV are with us for solar thermal and hybrid as well, they all need variations in code and training. But with PV, the whole industry is working to the resolution of the integration issues.

In conclusion, I'm sure that solar thermal and hybrid systems have their place in certain applications and climates in building technologies, but only a fool would bet against straight-ahead PV, it's the baby gorilla of the energy industry.

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

DIAGRAM OF SOLAR ENERGY:



Q2: What is the technical difference between grid forming and grid supporting inverters? Back your answer with valid data, facts and figures.

ANS:

GRID FORMING:

The inverter is connected at a bus in the network. The grid is "seen" by inverter at that bus, and this perception is in the form of voltage and frequency. Question is who is responsible for maintaining that voltage/frequency? Whether V/f will still be maintained if inverter under consideration is disconnected? Every type of inverter injects power into the bus it's connected, however the key deciding factor of its role as grid forming/feeding/supporting is maintaining V/f.

Technically, if inverter control structure directly incorporates voltage tracker/regulator and its frequency is auto-generated (not sensed from bus), then it's a grid forming inverter.

On contrary, if voltage tracker is not employed and frequency reference is obtained from sensed/measured/estimated frequency locked to the corresponding bus by mechanism like PLL or FLL, then it's grid following.

GRID SUPPORTING:

Grid support is an additional feature; a grid supporting inverter can be of both types: grid forming or feeding. If the references/set-points of inverter (set-points includes voltage, frequency, active/reactive power, virtual flux, virtual torque, injected currents etc.) are adjusted based on "additional" inputs from information of other buses/loads in the network, for serving extra ancillary features (apart from local v/f regulation and power injection), then the inverter is said to "support the grid". The additional support include: power quality enhancement, stability support, reserve provision, event ride-through, economic dispatch etc.

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

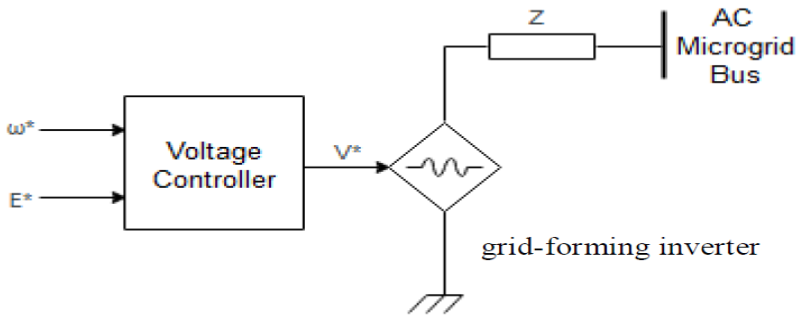
EXAMPLES:

1) Parallel connected droop controlled inverters: All inverters contribute or participate in process of grid formation by means of droop coefficients. They serve additional purpose of power sharing; hence they are both grid forming and grid supporting.

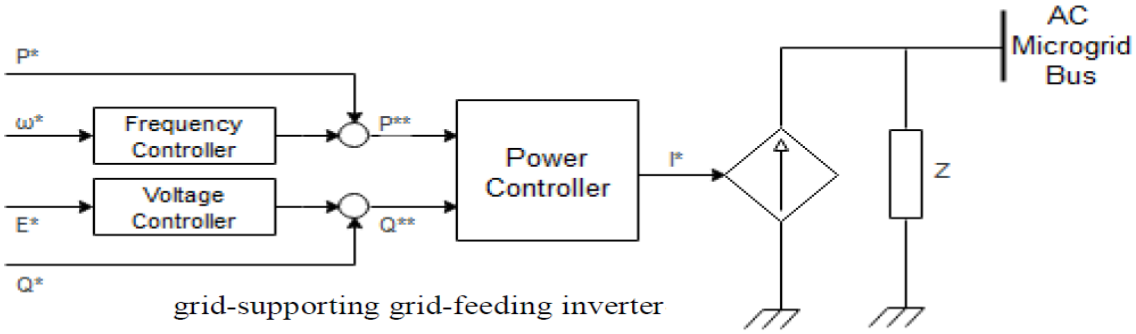
2) PV inverters always operated at MPP: Irrespective of V/f of the bus it's connected, it only injects available peak power into grid, hence only grid feeding

FIGURES:

GRID FORMUNG:



GRID SUPPORTIG:



Student Details

Name: AZHAD NIAZ **Student ID:** 15493

Q3: Electric cars and hydrogen cars both run on apparently clean fuels. However, the source of electricity or hydrogen production may be based over partially clean processes. It is a question of the future, which of them will prevail.

ANS:

Hydrogen fuel cell technology and electro mobility should become economical and safe in the future. However, currently hydrogen production is not cheap. The storage of hydrogen, e.g. in cylinders in cars that would be fueled by this fuel, is associated with a high risk of a dangerous explosion.
To see what the future holds, it is good to see the sustainability of the sources both Battery electric and fuel cell vehicles use. Hydrogen production by electrolysis needs only water and electricity and the byproduct is oxygen, still very useful and environmental friendly.

Hydrogen is the most abundant on earth in water, H_2O less in the air. Battery on the other hand uses chemicals and metals which is not as abundant as hydrogen. We have to see another factor: the specific energy and energy density. Hydrogen has the highest top on its calorific value per gram but low in energy density due to its light weight. If research succeed in the near future in increasing the density of on board hydrogen storage for fuel cell 40g/l and 5.5% H_2 by weight and even more, Fuel cell car is the future.
Bur battery technology is also in development, now Lithium ion is good for electric vehicle application with both specific energy and energy density perspective. Plug in EV is very famous now but it needs a lot of battery to cover a long range. The best way I prefer is a hybrid between fuel cell EV and Battery will increase the efficiency and performance of the system. For instance fuel cell in not very responsive for dynamic loads and acceleration as the compression command and response takes time poor load following, but battery is very good at this and it supply the demand power very quickly in no time.

The Earth's population is growing towards 7.5 billion people in 2018 and is expected to continue to grow until the world's marginal population of 10 billion. Recently, there are an estimated 800 million cars on the planet, and it is expected to be 1.7 billion by 2040 as the population and economy grow. This huge number of cars will consume a lot of energy and cause a lot of pollution on the planet. Therefore, developing a greener car that consumes less fossil fuel and emits less pollutants is essential for a sustainable society in the future.

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

Q4: Is it possible to control speed using Boost Converter? Give your answer with proper example.

ANS:

We control the speed of the induction motor by changing the motor voltage while V while keeping V/F constant where F is the frequency of the voltage applied on the motor. This condition is required to keep the flux phi constant.
So, yes we can use DC/DC boost converter to control the voltage and then you can use DC/AC inverter to generate the AC for the motor. You have to change the frequency of the inverter by changing the switching speed of the inverter switches. You have to generate as sinusoidal waveform as possible.

DC Source --> Boost Converter with Single IGBT --> Z Source Inverter ---> 1ph Inverter with 4 IGBT --> 1ph Induction motor

Q5: Describe the effect on distortion on the output frequency of the cyclo converter? Backyour answer with valid data, facts and figures.

ANS:

A cycloconverter is a device that converts AC, power at one frequency into AC power of an adjustable but lower frequency without any direct current, or DC, stage in between. It can likewise be acknowledged as a static recurrence charger and holds silicon-regulated rectifiers.

As the output frequency increase the distortion increase and vice versa

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

Types of Cycloconveters:

Based on the output frequency and number of phase in the input AC power source the cycloconverter can be classified into two types

1. **Step-up cycloconverter**

2. **Step-down cycloconverter**

Step-up cycloconverter:

This type of ccv provide output frequency greater than of input frequency but it is not widely used since it is not have much particle application most application will require a frequency less than 50hz which is the different frequency also step up ccv will require forced commutation which increase the complexity of the circuit.

Step-down cycloconverter:

This type of cycloconverter have guessed it well just provides an output frequency which is lesser than the input frequency these are most commonly used and work with the natural commutation hence comparatively easy to hold and operate the step down CCV is further classified into three types.

(i) Single phase to single phase cycloconverter

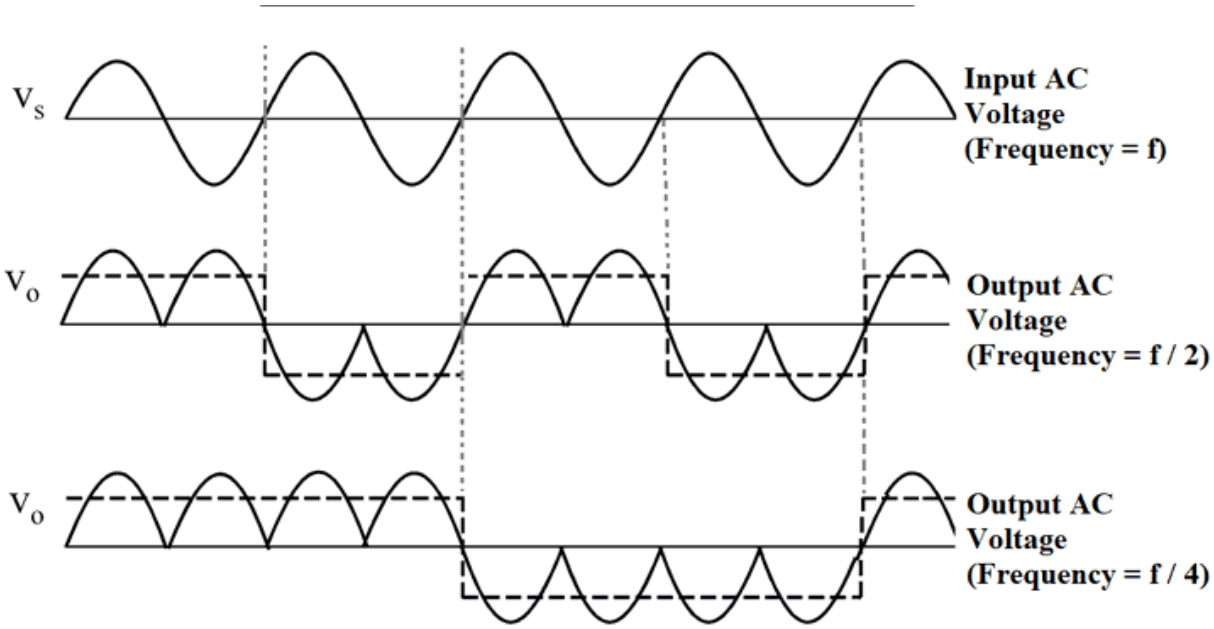
(ii) Three phase to single phase cycloconverter

(iii) Three phase to three phase cycloconverter

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

DIAGRAM:



-