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Course Power Electronic

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Question (1)

Answer:

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 region has been developing this new form of using solar photovoltaic.

-> The total capacity of solar photovoltaic grew at rates averaging 60% annually.

→ Concentrating solar thermal power capacity increased more than 40% per year on average - growing from a small base and wind power increased 25% annually over this period.

★ Solar thermal And Hybrid:-

→ Solar thermal and hybrid just seem to have an increasingly though 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 keep making it harder for everything else to compete.

Problem arise for the real integration:-

The problems about integration with PV are with us for solar thermal and hybrid as well, they all need variation in code and training. But with PV the whole industry is working to the resolution of the integration issue.

Conclusion:

Solar thermal and hybrid system both have their own place in certain application and climates in building technology.

Question (2) (4)

Answer:

Grid forming inverters:-

This type of converters is associated to the ESD and have two main objectives.

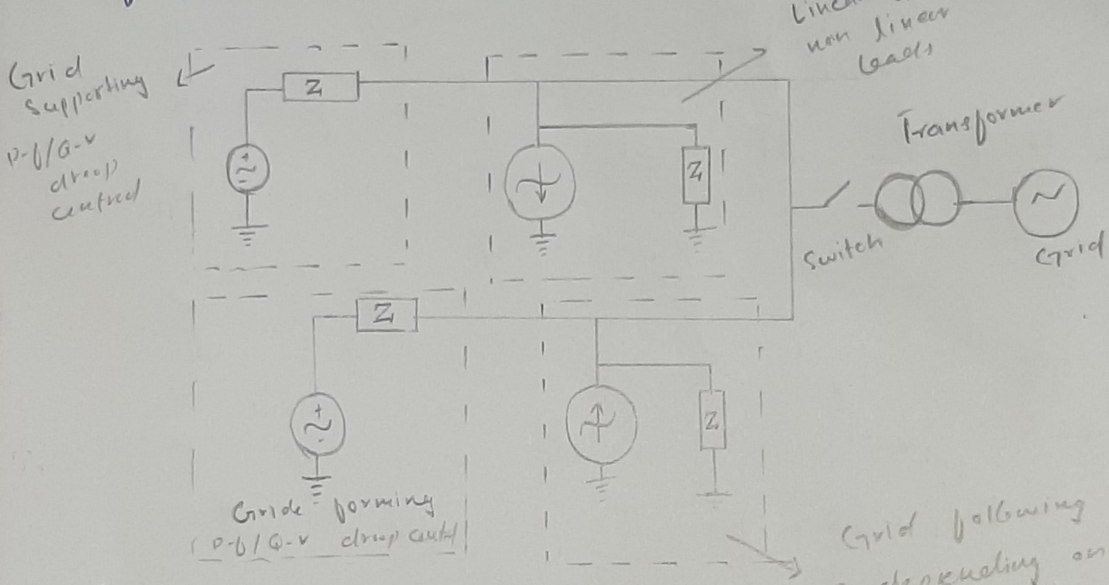
One for gride connected and another for islanded operation.

During gride connected operation, gride forming inverters regulate the active and reactive power injected to the A.C but to maintain the state of charge of the ESD and, In some cases, to improve the power quality.

In islanded operation it is necessary to form or generate the Sinusoidal voltage in the buss; such a task is performed by gride forming inverters, which can be represented as a controlled voltage source with a low impedance in series.

-> Gride forming inverters typically have droop control to regulate both the output voltage frequency and magnitude by modifying the active and reactive power, respectively.

-> The gride forming inverter discharge and charges the ESD when power is injected to or absorbed from the AC bus respectively.



★ Grid Supporting Inverters:-

-> Grid supporting inverters depending on the MG characteristics a grid forming inverter may not be able to maintain the frequency (f) and voltage (v) of the A.C bus within the desired limits due to the limited amount of energy that can

be absorbed or delivered by ESD.

-> Hence, dispatchable generator and / additional ESD are used to help grid forming converters in islanding operation.

-> The inverters connected to those generators or additional ESD are named gride supporting inverters, and those are equipped with droop controllers to provide the P and Q with the aim of maintaing the power quality in the A.C bus

-> In islanded mode the control of gride supporting inverters is typically adjusted to operat as controlled voltage source.

-> During grid connected operation those gride supporting inverters do not operate or may be used to improve the power quality of A.C bus.

Question (3)

Answer:-

★ Electric Car:-

→ Electric vehicles, are powered by electric motors that pull current from a rechargeable battery or other portable sources of electricity. Once they are moving, there's no chemical reaction happening either, only an electric one thanks to the power batteries were previously charged with.

★ Hydrogen Car:- ↳ hydrogen fuel car has a hydrogen tank that feeds a fuel cell with high pressured hydrogen gas that'll mix with oxygen

-> This mean starts an electrochemical reaction that produces electricity to power the electric motor.

-> This mean hydrogen cars have characterishes of both electric cars and conventional petrol car.

Electric Cars Vs Hydrogen Cars, which is more Sustainable.

To see what the future holds, it is good to see the sustainability of both electric cars and hydrogen cars.

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) though less in the air.

-> Battery on the other hand uses chemicals and metals which is not as abundant as hydrogen.

-> 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.

-> Fuel cell car is the future. But battery technology is also in development, now lithium ion is good for electric vehicle application with both specific energy and energy density perspective.

-> Fuel cell and electric vehicals is indeed our future, Hybrid FCEV will still be more competent in the future.

Question (4) (10)

Answer:

- Yes it is possible to control speed by using boost converter.

→ For this purpose we use DC/DC boost converter to control the voltage and then DC/A.C inverter to generate the A.C for the motor.

→ we can have to change the frequency of the inverter by changing the switching speed of the inverter switches.

→ We have to generate as sinusoidal waveform as possible.

Example: The speed of induction motor is control by changing the motor voltag

while kepping V/F Constant.

where (F) is the frequency of the voltage applied on the motor.

This Condition is required to keep the flux Phi (ϕ) Constant.

Question (5)

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Answer:

-> There are several factors effecting the harmonic content of the waveforms.

-> Blocking mode operation produces more complex harmonics then circulating mode of operation due the zero current distortion.

-> The pulse number effect the harmonic content.

-> A greater number of pulses has less harmonic content. Therefore a 6 pulse cycloconverter produces less harmonics then a 3-pulse Cycloconverter.

-> If the output frequency gets closer to the input frequency, the harmonics increase, Finally low power factor and discontinuous Conduction, both contribute to harmonics.

→ The firing angle, α in cycloconverter operation is sinusoidally modulated.

→ The modulation frequency is the same as the output frequency and sideband harmonic are induced at the output.

→ Therefore, the output waveform is expected to have harmonic at frequency related to both the input and output frequency.

→ For blocking mode operation, the output harmonics are found at "$pnf_i + Nf_i$", where (N) is an integer and $pn \pm N = odd$ Condition is satisfied.

→ For the Circulating mode operation, the harmonic are at the same frequencies as the blocking mode but (N) is limited to (n+1).

→ The output voltage of cycloconverter has many complex harmonics, but the output current is smoother due to heavy machine filtering.