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REVIEW ON INDUSTRIAL GENERATORS LOAD SHARING SYSTEM ALONG WITHGRID MOMENTRY SYNCHRONIZATION AND SETUP A BACKUP UNIT FOR AUXILIARY POWER FOR GENERATORS

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ABSTRACT: In this Industrial Define Project we are going to solve the load sharing problems of an industry by sharing electrical power for different type of loads in industry through parallel generating sources by "load sharing control system". To overcome the overloading and stability problems on system generating sets and so increase the capability of system. There are many different methods for load sharing between parallel generators. In the report we had discussed all, but we take the best one for paralleling the generators.Connecting different communication systems is possible on the prime-mover side through a converter. According to the information gathered in this thesis it is recommended that a PLCs are used for load sharing between the existing power plants.We will also going to setup a network of momentary synchronization of utility grid with generators. The grid is used as an emergency source for the loads of an industry. The synchronizing of grid with generators will be helpful inuninterrupted continuous power supplyto the loads connected in the industry at the time ofgenerators taken again onto load after any breakdown or blackout condition of the generators. Providing rapid backup unit to supply power to auxiliaries of the generating sets, at the time of any breakdown or any inconvenience occurred in the generating system. This will reduce the losses of generators as well as losses of industrial plants working from power of the generators. An open network has to be made that can connect an emergency D.G set to the power control center of the auxiliaries of both the generators that has been paralleled.

I. GENERAL OVERVIEW

A. Load Sharing Between Two Generators :-

- Load sharing is defined as the proportional division of the kW and kVARtotal load between multiple generator sets in a paralleled system.
- Generator sets cannot operate in astable fashion in parallel with othersources unless the loading on thegenerator set is controlled. Whengenerator sets are operating togetheron an isolated bus (that is, notgrid-paralleled), they are commonlyprovided with equipment to alloweach machine to operate at the samepercentage of load as the percentageof load on the total system.
- This istermed a "load sharing controlsystem." Many options are availablefor load sharing controls from variousmanufacturers, and many of theseoptions are not compatible witheach other. So, when consideringthe paralleling of dissimilar generatorsets, or adding generator sets to anexisting paralleling system, it iscritical to understand how loadsharing can be accomplished.
- When a generator set is in a paralleled arrangement, the voltage and frequency outputs of the generator sets are forced to exactly the same values when they areconnected to the same bus. Consequently, generator set control systems cannotsimply monitor bus voltage and speed as a reference for maintaining equaloutput levels, as they do when operated in isolation from one another.
- Load sharing is essential to avoid overloading and stability problems on the systems' generator sets.

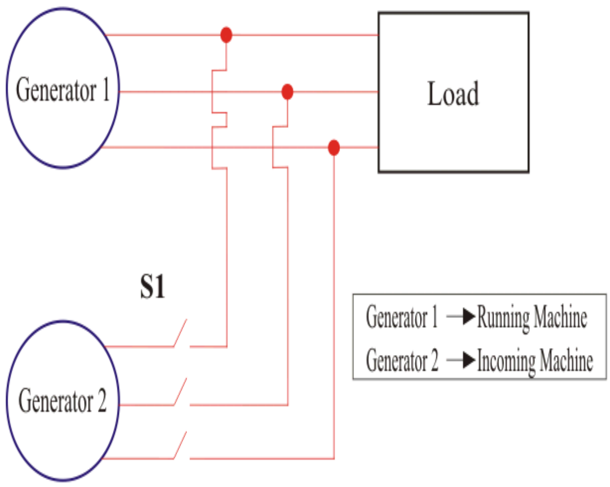


Fig. 1.1 Load Sharing Between Two Generators

B. Synchronizing a Generator with the Utility Grid :-

- Consider adding a generator to an infinite bus supplying a load. The frequency and terminal voltage of all machines must be the same.
- Therefore, their power-frequency and reactive power-voltage characteristics can be plotted with a common vertical axis.
- If the no load frequency of the generator is slightly higher than the system frequency, the generator will be floating. And if the generator frequency is slightly lower than the system frequency, the generator will supply negative power to the system (acting like a motor).

- If an attempt is made to increase the speed of the generator after it is connected to the infinite bus, the system frequency cannot change and the power supplied by the generator increases.
- Note an increase in power (with Vt and EA staying constant), results in an increase in the power angle δ. By adjusting the field current of the machine, it is possible to make it to make the generator supply or consume reactive power Q.

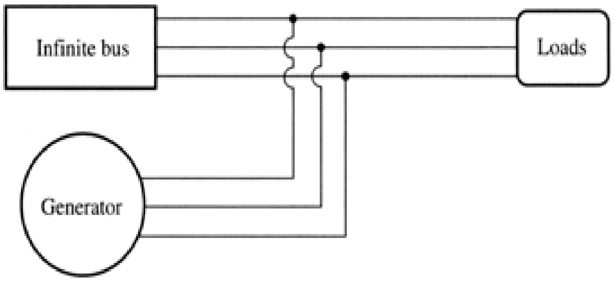


Fig. 1.2 Synchronization of utility grid and generator

C. Synchronization:-

- This is the process in which the voltage and frequency of the generators are matched to provide a standard AC output waveform.
- For the generators to be paralleled and synchronized correctly, each of the sets should have the below characteristics:

1. Frequency : The frequencies must be the same of both generators.
2. Voltage : The generators should produce or be set to produce the same voltage.
3. Phase number : The two systems should have the same number of phases, either three or single phase.
4. Phase rotation : For three phase systems, each of the three phases must be matched. This prevents excessive mechanical and electrical stresses as well as avoiding power surges.
5. Voltage Phase : The waveforms should be matched such that they rise and fall together. There should be no angle difference and the potential difference between the phases should be zero.

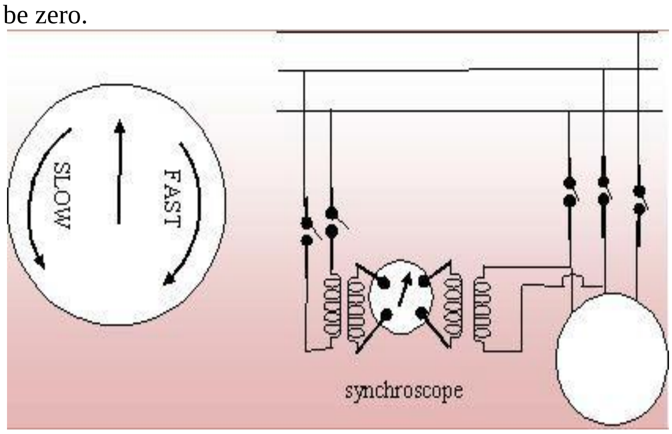


Fig 1.3 Synchroscope for Synchronization Test

II. CONTROL STRATEGY FOR SYNCHRONIZATION

General:

The study of interconnection of several synchronous generators is importantbecauseof the following main reasons:

- Since the demand of electricity varies during a day, also during the various seasons in a
- year, a modern power station employs two or more units so that one or more alternators can supply power efficiently according to the need.
- Installation of a single generator ofcapacity equal to the installed capacity of a station will be uneconomic, as such agenerator will have to be run at a reduced load for certain periods of the day, and alsobuilding of such a generator is difficult proposition.
- Further, routine maintenancerequires a unit to be shut down for a certain period of time and as such the capacityrequirement of the stand by unit in a power station with several alternators is less.
- Connections of several stations by a grid is economic and advantageous. This reduces the installed capacity of the stand by unit considerably, and enables economic distributions of load between several stations.
- Also, in a country like India, where considerable amount of power is generated by harnessing power,parallel operation of the steam generators is essential to maintain continuity of supply throughout the year and also toensure the maximum utilization of power.

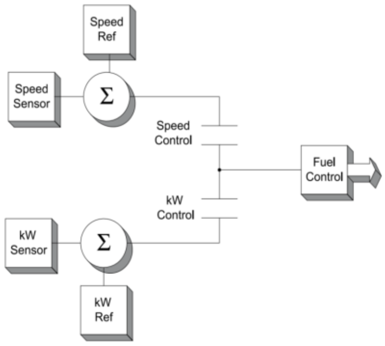


Fig 3.1 Control Strategy

Load Sharing Factor:

- When a generator set is in a paralleled arrangement, the voltage and frequency outputs of the generator sets are forced to exactly the same values when they are connectedto the same bus.

- Consequently, generator set control systems cannot simply monitor bus voltage and speed as a reference for maintaining equal output levels, as they do when operated in isolation from one another.

- If, for example, one set operates at a higher excitation level than the other sets, the reactive load will not be shared equally. Similarly, if a generator set is regulated to a different speed than the others, it will not share kW load properly with other generator sets in the system.

- Each generator set in the system has two active control systems always in operation: the excitation control system regulating voltage, and the fuel control system regulating engine speed.
- Generators can be sharing kW load and have problems sharing kVAR load, and vice versa. Successful load sharing requires addressing of both kW and kVAR load sharing, under both steady state and transient conditions.
- Real power sharing (expressed as kW or unity power factor load) depends on speed control and fuel rate control between the generator sets based on percentage of kW load.
- Reactive power (expressed as kVAR or zero 02 Power Topic #9017 power factor load) is primarily dependent upon voltage control and excitation system control that is dependent on the percentage of load between the generator sets.
- Although it is sometimes possible to integrate systems from different manufacturers, generator set governors and load sharing controls should be of the same manufacturer and model to avoid conflicts in responsibility for proper system operation.
- When that is not possible or practical, the detailed options of this paper can be consulted for alternatives. Several types of load sharing control are available:

1. Droop governing and voltage regulation (“reactive droop compensation”).
2. Isochronous kW load sharing.
3. Isochronous voltage kVAR load sharing.
4. Cross current compensation for kVAR load sharing

- When generator sets operate in parallel, the engine speed governorof eachgenerator set determines the proportional sharing of the total active powerrequirements (kW) of the system.
- The kW load sharingis achieved by increasing or decreasing fuel to thesystems’ engines.As the fuel to the engine of one generator set in a group is increasedit will notlead to an increase in speed and hence frequency (as it would if it wereoperating alone) but it will lead to an increase in the proportion of the total kWload that it will deliver.
- As the fuel to the engine of one generator set in a group is decreasedit will notlead to a decrease in speed and hence frequency (as it would if it wereoperating alone) but it will lead to a decrease in the proportion of the total kWload that it will deliver.
- The control system of the generator sets (via the engine speed control system)monitors and controls the sharing of the total kWload in proportion to therelative rating of the engineson the systems’ generator sets.

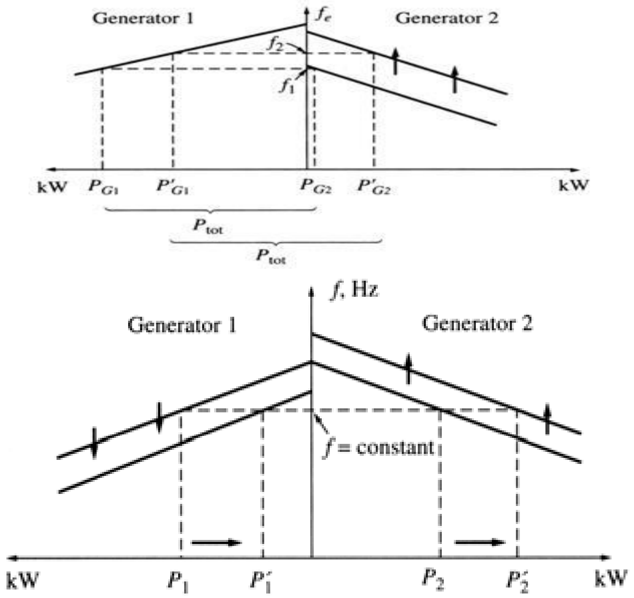
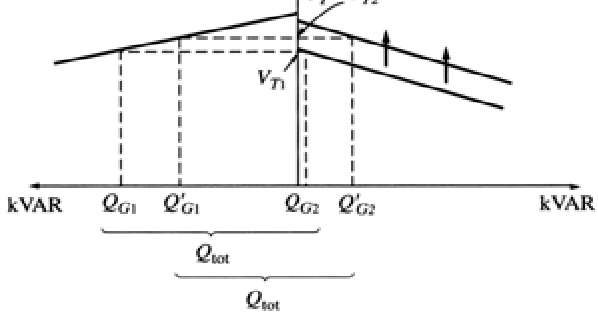


Fig 3.2 KW/Frequency Graph of Parallel Generator

- When generator sets operate in parallel the alternator field excitation systemof each generator set controls the proportional sharing of the total reactivepower requirements (kVAR) of the system.
- The kVAR load sharing is achieved by increasing or decreasing the fieldexcitation to the systems’ alternators.As the field excitation of one generator set in a group is increased i.e. overexcitedit will not lead to an increase in voltage (as it would if it were operating alone) but it will lead to an increase in the proportion of the total kVAR load itwill deliver and a decrease in its power factor.
- As the field excitation of one generator set in a group is decreased i.e. under excitedit will not lead to a decrease in voltage (as it would if it were operatingalone) but it will lead to a decrease in the proportion of the total kVAR it will deliver an increase in its power factor.
- An undesirable circulating reactive current (cross current) will flow in the systemif the excitation of the alternators is not matched. The voltage control system of the generator sets (via the alternator voltagecontrol system) monitors and controls the sharing of the total kVAR load inproportion to the relative rating of the alternators on the systems’ generator sets.



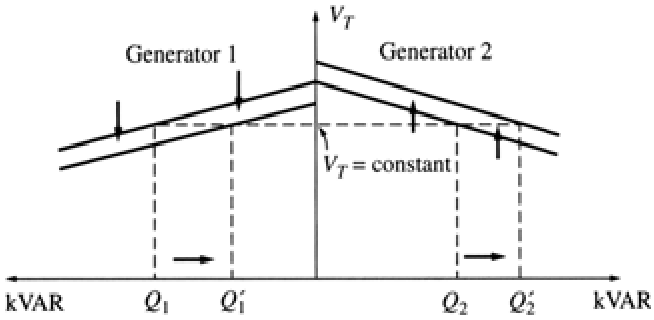


Fig 3.3 kVAR /Voltage Graph of Parallel Generators

The General Procedure for Paralleling Generators

If generator G2 is to be connected to the running system, the following steps should be taken to accomplish paralleling:

- The terminal voltage of the oncoming generator should be adjusted by changing the field current until it is equal to the line voltage of the running system.
- The phase sequences of the oncoming generator and of the running system should be the same. The phase sequence can be checked by using the following methods.
- A small induction motor can be connected alternately to the terminals of each of the two generators. If the motor rotates in the same direction each time, then the phase sequences of both generators are the same. If the phase sequences are different, the motors will rotate in opposite directions. In this case, two of the conductors on the incoming generator must be reversed.
- Figure 3.3 illustrates three lightbulbs connected across the terminals of the switch connecting the generator to the system. When the phase changes between the two systems, the lightbulbs become bright when the phase difference is large and dim when the phase difference is small. When the systems have the same phase sequence, all three bulbs become bright and dim simultaneously. If the systems have opposite phase sequence, the bulbs get bright in succession.
- The frequency of the oncoming generator should be slightly higher than the frequency of the running system. A frequency meter is used until the frequencies are close; then changes in phase between the the generator and the system are observed.
- The frequency of the oncoming generator is adjusted to a slightly higher frequency to ensure that when it is connected, it will come on-line supplying power as a generator, instead of consuming it as a motor.
- Once the frequencies are almost equal, the voltages in the two systems will change phase relative to each other very slowly. This change in phase is observed, and the switch connecting the two systems together is closed when the phase angles are equal. A confirmation that the two systems are in phase can be achieved by watching the three lightbulbs. The systems are in phase when the three lightbulbs all go out (because the voltage difference across them is zero).
- This simple scheme is useful, but it is not very accurate. A synchroscope is more accurate. It is a meter that measures the difference in phase angle between the a phases of the two systems. The phase difference between the two a phases is shown by the dial. When the systems are in phase (0° phase difference), the dial is at the top. When they are 180° out of phase, the dial is at the bottom.
- The phase angle on the meter changes slowly because the frequencies of the two systems are slightly different. Since the oncoming generator frequency is slightly higher than the system frequency, the synchroscope needle rotates clockwise because the phase angle advances. If the oncoming generator frequency is lower than the system frequency.
- Machine voltage now equal to system. Voltage waves out of phase but frequency being increased by increasing speed of prime mover. Machine voltage now equal to system, in phase and with equal frequency. Synchroscope shows 12 o'clock. Switch can now be closed needle rotates counterclockwise.
- When the needle of the Synchroscope stops in the vertical position, the voltages are in phase and the switch can be closed to connect the systems.However, the Synchroscope provides the relationship for only one phase. It does not provide information about the phase sequence.The whole process of paralleling large generators to the line is done by a computer. For small generators, the operator performs the paralleling steps.
- Frequency-Power and Voltage-Reactive Power Characteristics of a Synchronous Generator.
- The mechanical source of power for the generator is a prime mover such as diesel engines or steam, gas, water, and wind turbines. All prime movers behave in a similar fashion. As the power drawn from them increases, the rotational speed decreases. In general, this decrease in speed is nonlinear. However, the governor makes this decrease in speed linear with increasing power demand.

$$SD = \frac{n_{nl} - n_{fl}}{n_{fl}} \times 100\%$$

- Thus, the governing system has a slight speed drooping characteristic with increasing load. The speed droop (SD) of a prime mover is defined by where *n*nl is the no-load speed of the prime mover and *n*fl is the full-load speed of the prime mover. The speed drop of most generators is usually 2 to 4 percent. In addition, most governors have a set-point adjustment to allow the no-load speed of the turbine to be varied.

- The reactive power *Q* has a similar relationship with the terminal voltage *VT* . As pre viously described, the terminal voltage drops when a lagging load is added to a synchronous generator. The terminal voltage increases when a leading load is added to a synchronous generator.
- This plot has a drooping characteristic that is not generally linear, but most generator voltage regulators have a feature to make this characteristic linear. When the no-load terminal voltage set point on the voltage regulator is changed, the curve can slide up and down
- The frequency-power and terminal voltage-reactive power characteristics play important roles in parallel operation of synchronous generators. When a single generator is operating alone, the real power *P* and reactive power *Q* are equal to the amounts demanded by the loads.
- The generator’s controls cannot control the real and reactive power supplied. Therefore, for a given real power, the generator’s operating frequency fe is controlled by the governor set points, and for a given reactive power, the generator’s terminal voltage VT is controlled by the field current.

III. OBJECTIVE

Modeling of Parallel Generators Load Distribution Network

- To prepare a circuit of two load sharing generators, which share loads between each other such that no interruption of power source is occur to the industry load.

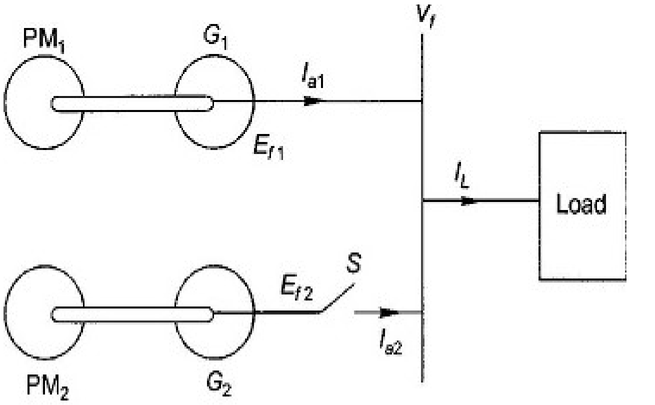


Fig 4.1 Parallel Operation of Synchronous Generator

- The operation considered is that of a synchronous machine connected to infinite bus-bars. Here the parallel operation of two finite size synchronous generators will be considered, which is the large practical size generators are used.
- In a power system the generators are connected to the nodes of a grid composed of a network of transformers and transmission lines. A national level grid* may comprise even hundreds of generators and hundreds of kilometers of the transmission line. The grid formation is dictated by reasons of reliability (continuity of supply) and by investment and operating economics of the power plant.
- Figure 4.1 shows two synchronous generators along with their primemovers to be operated in parallel. After the two generators are brought to their respective synchronous speeds and their field currents adjusted to give nearly equal terminal voltages, switch S is closed in accordance with the synchronizing procedure. Active and reactive powers, supplied to the common load by each generator, are controlled respectively by their primemover throttles and field current.
- The active power-sharing between paralleled generators is dependent upon thedroop of the frequency (speed)-power characteristics of the primemovers and their governors. These characteristics are nearly linear for small changes in the operating (rated) frequency and power as shown in Fig. 4.2. These characteristics can be slided up or down by adjustment of the set points of their governors.

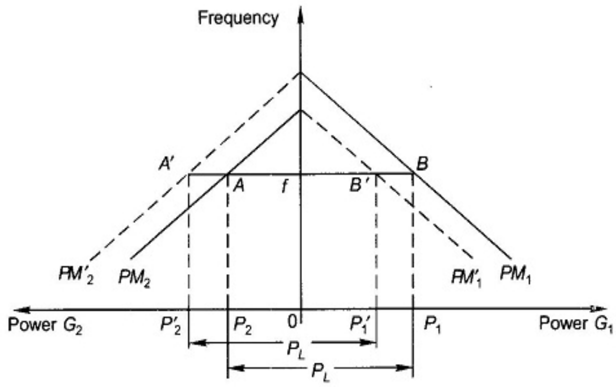


Fig 4.2 Primemover Frequency(speed) – Power Characteristics and load Sharing

- For the solid-line characteristics, load PL = AB at frequency f (rated) is shared as P1 and P2 such that P1 + P2 = PL. In order to increase the load on G2 and to correspondingly reduce the load on G1, the frequency-power characteristic of G2must be raised by adjustment of the governor setting, and to keep the frequency constant the characteristic of G1 must be simultaneously lowered. It is seen from the figure that with this adjustment, PL = P i + P’2 where (P1 — P’1) = (P’2 — P2) = 4P, the load amount which is transferred from G1 to G2 by adjustment of governors.
- It also follows that if the governor setting of only one of the primemovers is adjusted, the system frequency would change. During the process of governor setting adjustment, the system undergoes load-frequency transient which would soon die out (provided the governors are properly damped) and steady load-frequency conditions established with new load sharing.

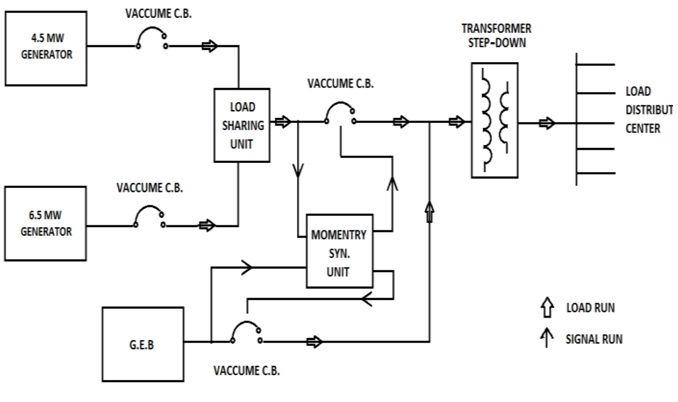
Synchronization of Utility Grid with Generators

- We will also going to setup a network of momentary synchronization of utility grid with generators. The grid is used as an emergency source for the loads of an industry. The synchronizing of grid with generators will be helpful in uninterrupted continuous power supply to the loads connected in the industry at the time of generators taken again onto load after any breakdown or blackout condition of the generators.
- Consider adding a generator to an infinite bus supplying a load. The frequency and terminal voltage of all machines must be the same.
- Therefore, their power-frequency and reactive power-voltage characteristics can be plotted with a common vertical axis.
- If the no load frequency of the generator is slightly higher than the system frequency, the generator will be floating. And if the generator frequency is slightly lower than the system frequency, the generator will supply negative power to the system (acting like a motor).
- If an attempt is made to increase the speed of the generator after it is connected to the infinite bus, the system frequency cannot change and the power supplied by the generator increases.
- Note an increase in power (with Vt and EA staying constant), results in an increase in the power angle δ.

Auxiliary Backup System

- Providing rapid backup unit to supply power to auxiliaries of the generating sets, at the time of any breakdown or any inconvenience occurred in the generating system. This will reduce the losses of generators as well as losses of industrial plants working from power of the generators.
- An open network has to be made that can connect an emergency D.G set to the power control center of the auxiliaries of both the generators that has been paralleled.
- Provided standby backup unit to the generators so at the time of blackout instant power given to auxiliary and the generator can start again after solving problem, this save the equipment as well as money.

Project Overview



IV. METHODOLOGY

The work may be stated briefly as following.

- In electrical power generation, droop speed control is a speed control mode of a prime mover driving a generator connected to an electrical grid. This mode allows synchronous generators to run in parallel, so that loads are shared among generators in proportion to their power rating.
- The frequency of a synchronous generator is given by

$$F = \frac{PN}{120}$$

where

- F, frequency (in Hz),
- P, number of poles,
- N, speed of generator (in RPM).
- {\displaystyle F={\frac {PN}{120}}}The frequency (F) of a synchronous generator is directly proportional to its speed (N). When multiple synchronous generators are connected in parallel to electrical grid, the frequency is fixed by the grid, since individual power output of each generator will be small compared to the load on a large grid. Synchronous generators connected to the grid run at various speeds but they all run at the same frequency because they differ in the number of poles (P).
- A speed reference as percentage of actual speed is set in this mode. As the generator is loaded from no load to full load, the actual speed of the prime mover tends to decrease. In order to increase the power output in this mode, the prime mover speed reference is increased.
- Because the actual prime mover speed is fixed by the grid, this difference in speed reference and actual speed of the prime mover is used to increase the flow of working fluid (fuel, steam, etc.) to the prime mover, and hence power output is increased. The reverse will be true for decreasing power output. The prime mover speed reference is always greater than actual speed of the prime mover. The actual speed of the prime mover is allowed to "droop" or decrease with respect to the reference, and so the name.
- For example, if the turbine is rated at 3000 rpm, and the machine speed reduces from 3000 rpm to 2880 rpm when it is loaded from no load to base load, then the droop % is given by

$$\text{Droop\%} = \frac{\text{No load speed} - \text{Full load speed}}{\text{No load speed}}$$

= (3000 – 2880) / 3000
= 4%

- In this case, speed reference will be 104% and actual speed will be 100%. For every 1% change in the turbine speed reference, the power output of the turbine will change by 25% of rated for a unit with a 4% droop setting. Droop is therefore expressed as the percentage change in (design) speed required for 100% governor action.
- As frequency is fixed on the grid, and so actual turbine speed is also fixed, the increase in turbine speed reference will increase the error between reference and actual speed. As the difference increases, fuel flow is increased to increase power output, and vice versa.
- This type of control is referred to as "straight proportional" control. If the entire grid tends to be overloaded, the grid frequency and hence actual speed of generator will decrease. All units will see an increase in the speed error, and so increase fuel flow to their prime movers and power output.
- In this way droop speed control mode also helps to hold a stable grid frequency. The amount of power produced is strictly proportional to the error between the actual turbine speed and speed reference.
- It can be mathematically shown that if all machines synchronized to a system have the same droop speed control, they will share load proportionate to the machine ratings.For stable operation of the electrical grid of North America, power plants typically operate with a four or five percent speed droop. By definition, with 5% droop the full-load speed is 100% and the no-load speed is 105%.
- Normally the changes in speed are minor due to inertia of the total rotating mass of all generators and motors running on the grid.Adjustments in power output for a particular prime mover and generator combination are made by slowly raising the droop curve by increasing the spring pressure on a centrifugal governor or by an engine control unit adjustment, or the analogous operation for an electronic speed governor.
- All units to be connected to a grid should have the same droop setting, so that all plants respond in the same way to the instantaneous changes in frequency without depending on outside communication.
- When generator sets operate in parallel, the engine speed governor of each generator set determines the proportional sharing of the total active powerrequirements (kW) of the System.
- The kW load sharing is achieved by increasing or decreasing fuel to the systems' engines. As the fuel to the engine of one generator set in a group is increased it will not lead to an increase in speed and hence frequency (as it would if it were operating alone) but it will lead to an increase in the proportion of the total Kw load that it will deliver.
- As the fuel to the engine of one generator set in a group is decreased it will not lead to a decrease in speed and hence frequency (as it would if it were operating alone) but it will lead to a decrease in the proportion of the total kW load that it will deliver.
- The control system of the generator sets (via the engine speed control system) monitors and controls the sharing of the total kW load in proportion to the relative rating of the engines on the systems' generator sets.

Paralleled Generators and kW Load Sharing Control

- With two or more generators operating in parallel, the load will demand the power it requires as long as the bus voltage and frequency are maintained. From the view at the load, power supply from one generator, two generators in parallel, or a generator and a utility, the view is the same as long as the bus voltage and frequency are maintained.
- For two or more generators connected in parallel, we can look to the solution offered for the AVR in the talk earlier this week of voltage droop. For control of real power (kW), two generators must have the ability to adjust fuel in response to load changes while somehow allowing for adjustment of the load sharing between two generators.
- The most common way, and the oldest technique is to use speed droop compensation to do the job. To see what speed droop really is, let's consider a single generator connected to a variable load.
- If the governor is selected and adjusted to provide 5% speed droop, the governor will cause the engine speed to be a function of the real power loading as illustrated by the droop curve below.

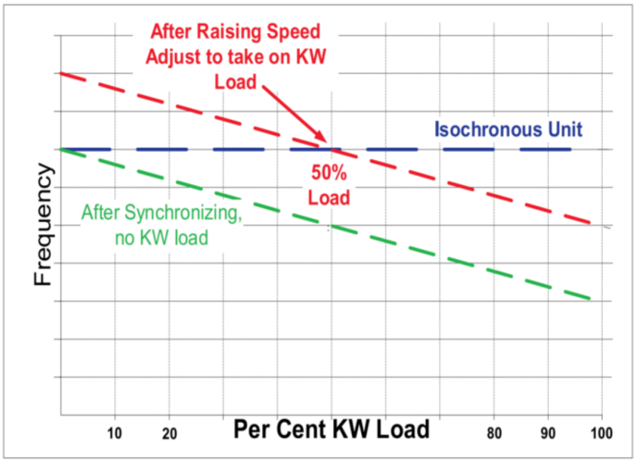


Fig 5.1 Speed Droop

- With speed matched and phase angle matched, the breaker may be closed, and the second unit will be operating in parallel with no load. The operator may now adjust speed up to begin taking some of the load from the lead unit. The kW load will not change with added or removed load from the bus, as all changes in load demand will be picked up by the lead unit.
- With increasing load, if the lead unit again approaches its maximum capacity, it will be necessary to add a third generator to the bus, again

operating in droop, set to the same droop as the second generator. It will be synchronized and loaded like the second unit, operating at fixed load with changes in load demand.

- When load decreases and the lead unit is operating too lightly loaded, a generator (the second or third machine) must be removed from the bus by unloading it and tripping its breaker.
- With electric governors, it is also possible to operate two or more governors in parallel without having in droop in speed, the so-called Asynchronous control. With this type of control, an external module or a built-in governor circuit connected to measure generator volts and amps is able to measure kW load on the generator it is controlling.
- The external module is often referred to as a load sensing module. Connections to CTs and PTs on the output of the generator supply the necessary information to the governor control.
- The calculated kW load of the generator is compared with a voltage from the Load Lines tying all the governors of the generators able to operate together. This voltage is representative of the total demand of the load. Using the speed adjust, the operator can set the amount of load for each generator operating in parallel.
- Each generator, in turn, monitors the total load using the voltage level on the load lines and adjusts fuel to keep its proportional share of load as the load varies up and down.

Parallel Generator Load Sharing Using Load Sharing Module

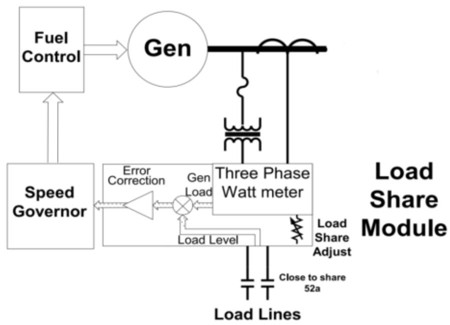


Fig 5.2 Governor with Load Sharing Module

- Instead of a droop governor, if the generator is equipped with an electric governor with isochronous load sharing capability, could the generator be paralleled and operated on the utility network? Yes, and in two different ways.
- One way is to equip the utility with a load sharing module (LSM) and connect the load sharing lines between the generator LSM and the utility LSM.
- Connected in this fashion, the utility and the generator would share the load, with the sharing ratio determined by the PT and CT ratios used to feed the two LSMs.
- A second way to use the Asynchronous speed governor is to feed a dc voltage, adjustable by a control by the operator, to set the voltage to the LSM to load up the generator when it is connected on line.
- Since the speed governor LSM compares its kW load to the voltage on the load lines, the load line voltage will cause the generator to take on load until its LSM sees equal load to the load line voltage. With this connection, the kW load is maintained constant at a level determined by the operator.
- To operate the generator at no load, one may short out the load lines. Opening up this switch to allow a fixed voltage on the load lines then ramps up the load on the generator, but this contact should only be opened when the generator is on line and paralleled to the utility.
- The utility is once again acting as the "lead generator" and must supply the additional load as required. This mode of operation is often referred to as "Base Loading", but this term is most often applied to large utility power generators used to operate the generator at or near rated load continuously for most economical operation.

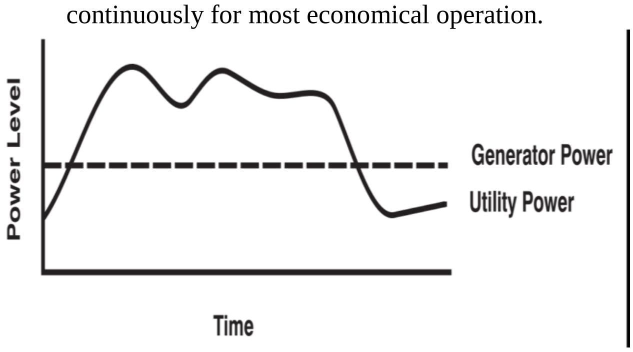


Fig 5.3 Power/Time Graph of Utility and Generator Power

V. CONCLUSION

Generators operating in parallel must have a means to share loads applied to system without being either overloaded or underloaded.Synchronous load sharing systems cause both generator sets in a system to operate at the same percentage of load, but they generally require that all the generator sets have a common load sharing control system in order to share load properly. All the load sharing controls should be of the same type and from the same manufacturer.At the time of on emergency or blackout when no power is there to supply the load, a utility grid can be taken in synchronization and generators can be taken out, to serve the load.Provided standby backup unit to the generators so at the time of blackout instant power given to auxiliary and the generator can start again after solving problem, this save the equipment as well as money.

REFERENCES

[1] Yung-terng wang, "Load Sharing in Distributed Systems" IEEE transactions on computers, Vol. C-34, No. 3, March 1985.

[2] Gary Olson, "Paralleling Dissimilar Generators"

2010 Cummins Power Generation.

[3] Gagari Deb, Ramananda Paul, and Sudip Das ,"Hybrid Power Generation System"; International Journal of Computer and Electrical Engineering, Vol.4, No.2, April 2012

[4] Prof. Aditi Shukla, Pravin Deshmane, Vitthal Garad & Dinesh Bhalerao, " plc based load sharing system" ; International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 02 | Feb -2017

[5] Nicholas C. Seeley, "Advances in Generator Control and Automatic Synchronization" Chevron USA© 2012 IEEE.

[6] Dibakar Das, Gurunath Gurrala, and U Jayachandra Shenoy, "Transition from Grid Connected Mode to islandedmode in VSI fed Microgrids" EPE-PEMC 2006,vol.no.3,April-2007

[7] Musa Baba Lawan, Yau Alhaji Samaila and Ibrahim Tijjani," Automatic Load Sharing and Control System Using a Microcontroller",AmericanJournal of Modern Energy. Vol. 3, No. 1, 2017.

