Chapter 6
Parallel Operations of DC Generators

ABSTRACT

There are numerous advantages of parallel operation of generators. In this chapter, the authors provide a detailed overview about advantages of parallel operation, voltage and current relations for sources of emf in parallel. Then they discuss parallel operation of shunt generators, conditions for parallel operation of shunt generators, and parallel operation of compound generators. Then they discuss the procedure of paralleling generators.

6.1 ADVANTAGES OF PARALLEL OPERATION

There are numerous advantages of parallel operation of generators. A system having number of power stations with smaller units has technical, economic and defensive advantages. The main advantages of parallel operation both on a system and station bases are:

- The use of number of smaller units increase the reliability of the station i.e. If there is only one unit and it fails, the whole station will shut down, but if there are a number of small units even if one unit fails, others will be working.
- The generators are efficiency at light loads is very low. So if a single unit is used it will be running at low efficiency at light loads. But if there are number of smaller units then at light load some of the generators may be switched off and thus providing maximum efficiency.
- It is very obvious that a machine cannot run without repair/overhauling etc. So if there is a single large unit, then in the even to repair, the whole station will have to shut down, but if there are number of small units, they can be repaired in turn.
- The load on the system increases always and so the system needs extensions; by parallel operation we can put new units in the system.

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- A single large unit can be how much big? It has physical and economic limits. For example for a system having loads of 40.000 MW a single unit can not be designed. A maximum capacity of a single unit may be about 1000 MW.

6.2 VOLTAGE AND CURRENT RELATION FOR SOURCES OF EMF IN PARALLEL

Let us consider a number of sources in parallel as shown in Figure 1 (D.C. generator obviously).

$$IL\ ZC = E_{g_1} - I_1Z_1 = Eg_2 - I_2Z_2 = Eg_3 - I_3Z_3$$

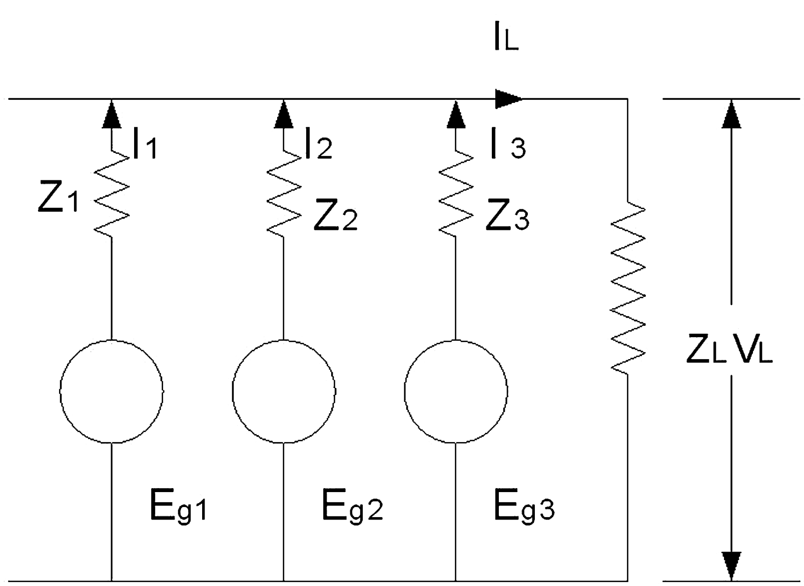
where I2 is load current, Z1, Z2, Z3 are internals resistances I1, I2 and I3 are the respective current delivered by each sources. Eg1, Eg2 and Eg3 are the generated internal emfs of each source.

Now there are three situations:

- Eg > VL, under this condition the source will provide power to the load.
- Eg = VL, the source will be just floating. It will neither provide nor draw power from the bus.
- Eg < VL, under this condition the source will draw power from the bus and will act as motor.

If Eg1 = Eg2 = Eg3 then all the sources will be providing power to the load and there will be now circulating current between them.

Figure 1.



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