School of Electrical, Electronics and Communication Engineering

Course Code : MPSE2502 Course Name: Power System Dynamics and Stability

UNIT IV

Active Power and Frequency Control

Name of the Faculty: Dr. Shagufta Khan Program Name: M.Tech

Contents

The Frequency of a system dependent upon active power balance.

Close control of frequency ensures constancy of speed of induction and synchronous motors.

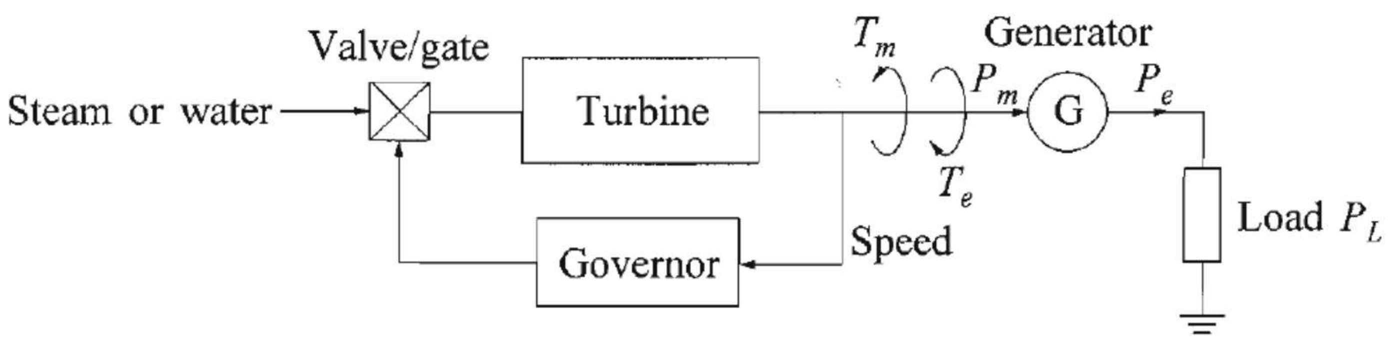
In a network drop in frequency could result in high magnetizing currents in induction motors and transformers.

As frequency is a common factor throughout the system, a change in active power demand at point is reflected throughout the system by a change in frequency.

Because there are many generators supplying power into the system, some means must be provided to allocate change in demand to the generators.

The control of generation and frequency is commonly referred to as load frequency control.

Fundamental of Speed Governing:



When there is a load change, it is reflected instantaneously as a change in the electrical torque output *Te* of the generator.
This cause a mismatch between the mechanical torque *Tm* and electrical torque *Te* which in turn results in speed variations as determined by the equation of motion.

The basic Concepts of speed governing are illustrated by considering an isolated generating unit supplying a local load.

Pm= Mechanical Power

Tm=Mechanical Torque

Pe= Electrical Power

Te= Electrical Torque

PL= Load power

Load Response of Frequency Deviation:

In general, power system loads are a composite of variety of electrical device.

For resistive loads, such as lightning and heating loads, the electrical power is independent of frequency.

In the case of motor loads, such as fans and pumps, the electrical power changes with frequency due to change in motor speed.

The overall frequency-dependent characteristic of composite load may be expressed as

$$\Delta P_e = \Delta P_L + D\Delta\omega_r$$

Where

ΔPL= non frequency-sensitive Load Change

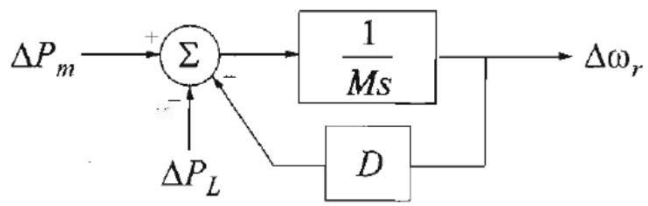
$D\Delta\omega r$ = Frequency-sensitive load change

D= Load-damping constant

The damping constant is expressed as a percent change in load for one percent change in frequency. Typical values of D are 1 to 2 percent.

A value of D=2 means that a 1% change in frequency would cause a 2% change in load.

The system block diagram including the effect of the load damping is showing below.



In the absence of a speed governor, the system response to a load change is determined by the inertia constant and the damping constant. The steady state speed deviation is such that the change in load is exactly compensated by the variation in load due to frequency sensitivity.

References

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