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(An Autonomous Institution)

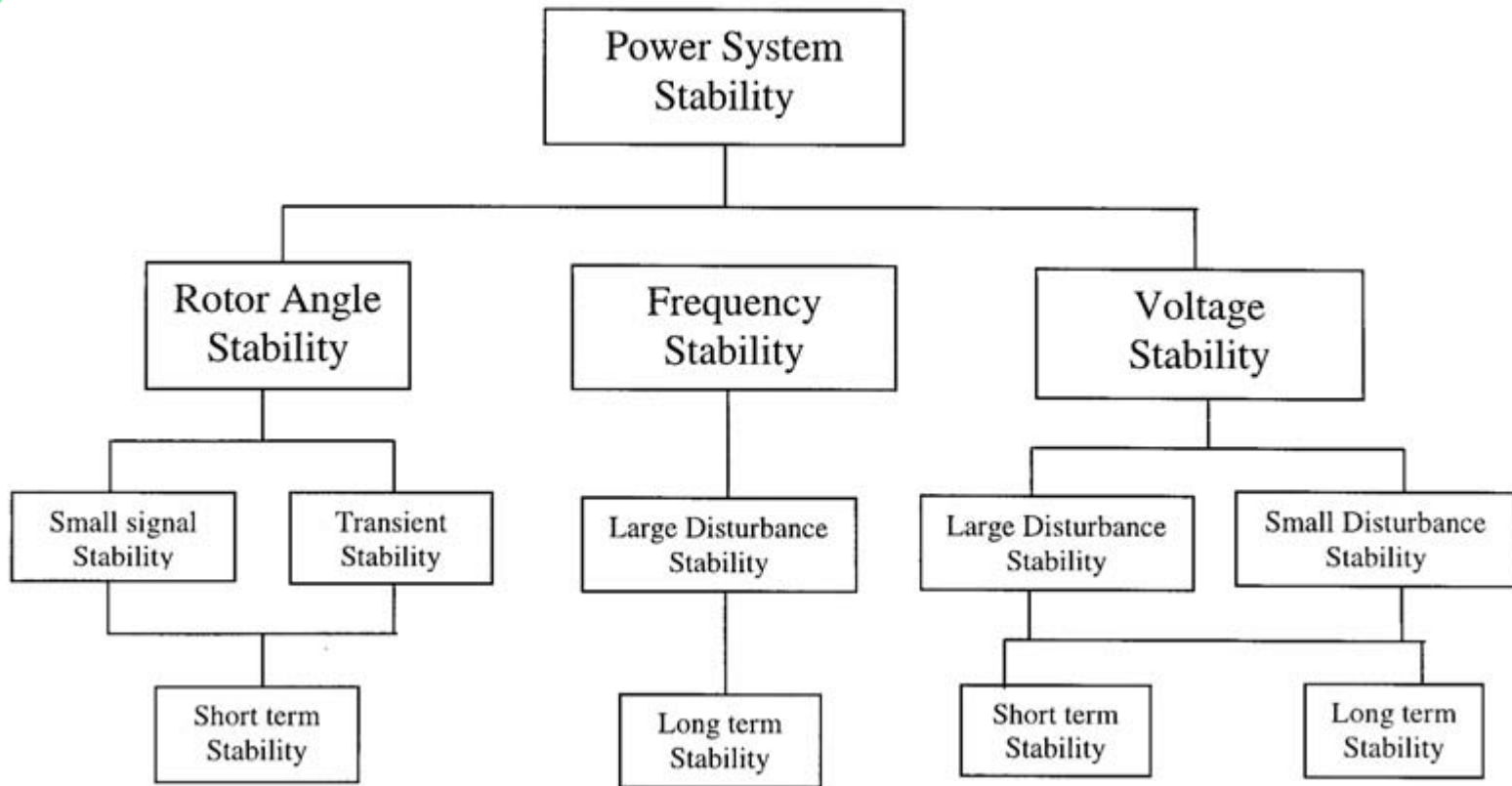
COIMBATORE-35

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19EEB302/ POWER SYSTEMS – II
III YEAR / VI SEMESTER
UNIT-II : STABILITY ANALYSIS

CLASSIFICATION OF POWER SYSTEM STABILITY





1. SMALL SIGNAL (OR STEADY STATE) STABILITY

It is concerned with the ability of the power system to maintain synchronism under small disturbances. The disturbances are considered to be sufficiently small that linearization of system equations is permissible for purposes of analysis. Such disturbances are continually encountered in normal system operation, such as small changes in load.

Small signal stability depends on the initial operating state of the system. Instability that may result can be of two forms: (i) increase in rotor angle through a non-oscillatory or aperiodic mode due to lack of synchronizing torque, or (ii) rotor oscillations of increasing amplitude due to lack of sufficient damping torque.

In today's practical power systems, small signal stability is largely a problem of insufficient damping of oscillations. The time frame of interest in small-signal stability studies is on the order of 10 to 20 s following a disturbance.



2. LARGE DISTURBANCE ROTOR ANGLE STABILITY OR TRANSIENT STABILITY

As it is commonly referred to, is concerned with the ability of the power system to maintain synchronism when subjected to a severe transient disturbance. The resulting system response involves large excursions of generator rotor angles and is influenced by the nonlinear power-angle relationship.

Transient stability depends on both the initial operating state of the system and the severity of the disturbance. Usually, the disturbance alters the system such that the post-disturbance steady state operation will be different from that prior to the disturbance.

Instability is in the form of aperiodic drift due to insufficient synchronizing torque, and is referred to as first swing stability.



B) VOLTAGE STABILITY

Voltage stability is concerned with the ability of a power system to maintain steady voltages at all buses in the system under normal operating conditions, and after being subjected to a disturbance. Instability that may result occurs in the form of a progressive fall or rise of voltage of some buses. The possible outcome of voltage instability is loss of load in the area where voltages reach unacceptably low values, or a loss of integrity of the power system.

As in the case of rotor angle stability, it is useful to classify voltage stability into the following subcategories:

1. LARGE DISTURBANCE VOLTAGE STABILITY

It is concerned with a system's ability to control voltages following large disturbances such as system faults, loss of generation, or circuit contingencies. This ability is determined by the system-load characteristics and the interactions of both continuous and discrete controls and protections.



Determination of large disturbance stability requires the examination of the nonlinear dynamic performance of a system over a period of time sufficient to capture the interactions of such devices as under-load transformer tap changers and generator field-current limiters. The study period of interest may extend from a few seconds to tens of minutes. Therefore, long term dynamic simulations are required for analysis.

2. SMALL DISTURBANCE VOLTAGE STABILITY

It is concerned with a system's ability to control voltages following small perturbations such as incremental changes in system load. This form of stability is determined by the characteristics of loads, continuous controls, and discrete controls at a given instant of time.



RECAP....



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