

# Transient Stability Assessment Of Multi Machine Power System And Enhancement Using Facts

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**Abstract**— This paper discusses EEAC (extended equal area criteria) and conversion of multi machine power system into single machine infinite bus (SMIB) to apply EAC(equal area criteria) for transient stability of multi machine power system using the parameter CCT (critical clearing time).This paper also discusses about the facts controller in enhancing the transient stability and effect of them over CCT.

**Keywords**— Equal area criteria(EAC), extended equal area criteria (EEAC),critical clearing time(CCT),clearing time(CT),single machine infinite bus(SMIB).

## I. INTRODUCTION

Power systems transient stability phenomena are associated with the operation of synchronous machines in parallel, and become important with long power transmission lines. Physically, transient stability is defined as the ability of power system to maintain machine's synchronous operation when subjected to heavy disturbance. As it is a strongly nonlinear and high-dimensional problem, to access it accurately, the numerical integration method can be used, which is commonly referred as the time-domain (T-D) methods. Historically, the time-domain methods came in the picture before the advent of computer. At that time the high dimensional nonlinear transient stability problem was reduced to simplified version and calculated manually. In this way the machine's swing curves were obtained [1] i.e. machine's rotor angle plot were evaluated.

Transient stability of a system refers to its capability of being stable when subjected to large disturbances such as instant faults, loss of generation or tripping of lines. This type of stability depends on the initial operation condition of the system and the severity of the disturbance as well. For any specified disturbance, there is always an associated power transference limit, called the transient stability limit, above which the system will become dynamically unstable. Also, the transient stability limit is always below the steady-state stability limit [2]. It may have many different values, depending upon the nature and magnitude of the disturbance. The stability can be generally classified as rotor angle stability and voltage stability. I emphasize mainly on rotor-angle stability which depends upon tCCT. Where tCCT is defined as the maximum time interval between the instant of fault

initiation and that of its clearing, up to which the power system remains transiently stable. There are two stability limits power limits and CCTs. As the computation of CCTs is easier than that of the power limits, so computation of CCTs is more popular and useful. CCTs may be used to tell about a system directly that whether the system is stable or unstable.

Popular method based on graphical interpretation of kinetic and potential energy, known as Equal-Area Criterion (EAC) has been used since thirties for power system stability analysis[4]. This method can be implemented on a one machine infinite bus (OMIB) system. The treatment of a large real system as a single machine equivalent (SMIB) is very popular and effective tool the EAC has been used to determine the transient stability limits and reduced the complete system into OMIB system [3] this work is popularly known as Extended Equal-Area Criterion (EEAC) It is a direct method for computing critical clearing time (CCT).

A much generalized application of EEAC on the basis of first-swing stability classifies the machines in any power network into two types Critical Machines (CM's) and Non-Critical Machine (NM's) mathematically. In revised EEAC for an assigned contingency (or fault, or disturbance) decompose the multi-machine system into two subsets: the "cluster of critical machine(s)" called for short the "critical cluster", and the group of the remaining machines and two equivalent machines are replaced by an OMIB [4]. By doing the analysis of IEEE14 bus system when a fault occurred near a bus the machine affected most is considered as critical machine and the rest of others are called non critical machines and thus a number of machines is divided into two groups critical machines and non critical machines now they can be simplified as one machine infinite bus(OMIB) and now the equal area criteria can be applied and assessment of transient stability can be done using the parameter critical clearing time(CCT).

The factors influencing the transient stability of power system are the transmission line reactance reactive power absorptions & injection. Since, transient stability of power system is directly related to the power flow in the transmission corridor and it is considered as a matter of energy balance. The mismatches in power can be well

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