

PROPOSAL FOR A BENCHMARK SYSTEM FOR POWER SYSTEM OSCILLATION ANALYSIS AND CONTROL

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Abstract : *This paper proposes an AC/DC benchmark system for power system oscillation analysis and control. Detailed results are described, in a tutorial manner, utilizing several complementary methodologies for linear dynamical systems. The paper contents are control oriented including aspects such as choice of adequate feedback loops and coordinated design of multiple controllers. Adequate oscillation damping is achieved by the use of stabilizing signals, designed through frequency response techniques and added to generator excitation, HVDC links, Static VAR Compensators and other FACTS devices.*

Keywords : *small-signal stability, AC/DC power systems, electromechanical oscillations, frequency response techniques, transfer function zeros, transfer function residues, stabilizing signals, static VAR compensators, HVDC links, FACTS devices, control system design.*

1 - INTRODUCTION

Some areas of power system engineering have long adopted benchmark models to enable performance evaluation of proposed algorithms, methodologies and computer codes. There, apparently, has never been a coordinated effort to develop a benchmark system for small-signal electromechanical stability. The IEEE Working Group on System Oscillations, of the System Dynamic Performance Subcommittee, is now supporting the development of some benchmark systems. CIGRÉ has sponsored, through its Power System Dynamics Performance and Analysis Working Group (WG 38.02), several valuable contributions to the small signal stability area [1,2,3]. It has also recommended the development of powerful eigenvalue programs for the analysis of small-signal stability of large power systems [1].

The authors believe that Study Committee 38 should now have the development of benchmark systems for small-signal stability as one of its priorities.

The New England Test System [4] has naturally become a sort of benchmark for multimachine small-signal stability. This is a good reason to support the inclusion of new dynamic components (HVDC links, SVC's, FACTS devices, etc.) to obtain an updated New England benchmark.

The proposed AC/DC benchmark system of this paper has many interesting features and the advantage of being smaller than an updated version of the New England system. This paper describes detailed results, utilizing several complementary methodologies of linear dynamical systems, concerning the oscillation analysis and control of the proposed benchmark system.

Non-linear time domain simulations were not considered. The notations adopted in the paper are defined as used, except for the well established symbols.

2 - THE PROPOSED BENCHMARK SYSTEM

The topology and parameters of the proposed system were based on a reduced equivalent of the AC/DC Itaipu transmission system. The one-line diagram of the system is shown in Figure 1 and its full data are given in Appendix I, so that every result of this paper may be reproduced.

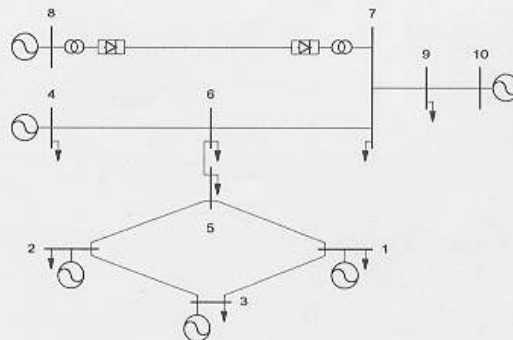


Figure 1. Proposed AC/DC Benchmark System