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POWER SYSTEM GENERATION AND TRANSMISSION PLANNING USING PROBABILITY METHODS

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ABSTRACT

Power system planners are constantly faced with the problem of finding the optimal way of designing, constructing and operating their systems to satisfy variable consumer demands in an environment of uncertainty.

Of the numerous phases of power system planning, the areas of long term generation planning, reservoir operation planning and transmission system planning have been selected for the studies reported in this thesis. The presence of inherent uncertainty in all these phases is recognised and the use of probabilistic solution methods is emphasised throughout.

The application of long term generation planning procedures to various power systems is illustrated and an interactive solution strategy is discussed. As the computing times for the integer optimisation techniques are generally high, a method of modifying the system constraints to reduce computing times without losing the accuracy of the solution is developed. Reductions of computing times by up to 40% have been realised using this method of modified constraints.

The uncertainty in water inflow to long term storage reservoirs is dealt with by using stochastic dynamic programming techniques. The optimum use of water storage in a mixed hydro-thermal system to reduce thermal power generation is illustrated. Cascaded or parallel operated hydro plants can be simplified to a single equivalent reservoir using the composite reservoir representation.

Adequacy of the transmission system is tested by calculating the reliability parameters at each consumer load point and also calculating overall system performance indices. As these indices are compatible with those used for distribution system reliability evaluation, they form a set of starting values for these studies. The applicability of

the method to medium sized power systems is demonstrated by using the Sri Lanka power network as an example.

Other areas which need to be explored more are identified and suggestions are made for further developments.

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To my parents
relatives & teachers
for their inspiration.

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TABLE OF CONTENTS

LIST OF FIGURES *

* Figures are attached at the end of each Chapter.

LIST OF TABLES *

* Tables are attached at the end of each Chapter.