

PREFACE

The authors of this monograph have not attempted to develop a textbook in power-system reliability calculations: It is more like a progress report, and it is hoped that the publication of this monograph will contribute to the growth of the use of analytical reliability techniques to design and analyze power systems. There are more unsolved than solved problems in this field.

Our purpose is to describe practical methods that have been utilized by the authors and their associates in solving actual power-system reliability problems. This experience has extended over a number of years and has included both work with graduate-level students in various programs and consulting engineering assignments with electric utilities in both North and South America.

The field is not new. Reliability methods have been used in the design of power-generation systems for some 40 years. The general problem is that of designing or evaluating the reliability of an ongoing system. This is not the same problem as the mission-oriented reliability problem of the space vehicle or defense electronics system that has received so much attention in recent years.

The monograph starts with applications to subsystem design by considering substation layout and generation-system reliability. These areas have received considerable attention, and the methods presented have evolved over a number of years. In the last two chapters the intent is more to give a progress report on the reliability aspects of combined generation- and transmission-system design and the reliable operation of power generation systems. There are, of course, other important reliability problems in the power system that have not been treated here.

It is our firm belief that the successful application of these power-system reliability calculation methods depends upon the simultaneous existence of three factors:

1. the development of an appropriate engineering model for the reliability problem at hand,
2. the establishment of an appropriate risk index, or index of service quality, and
3. the access of system and component operating and failure information from which reliability and availability parameters may be estimated.

The first is perhaps the easiest to accomplish. The second always involves a degree of subjectiveness that may lead to an endless debate in any specific case. The significance of the third is most often underestimated. In the past, the collection and processing of data has often lagged behind the development of reliability models. It is our hope that this monograph may in some small way serve to spur these efforts. We have attempted to include an adequate description of the required data along with the development of each model.

Finally, the authors would like to express their appreciation for the many contributions of their current and past associates. This must include those many members of groups sponsored by the IEEE, the EEI, and the CEA. Much of the material in this monograph has been taken from technical papers published by the IEEE. We wish to express our appreciation for the permission to use this material. We would also like to thank Sarah N. Ringlee for drafting the illustrations and Mrs. Roy Billinton for her assistance in the preparation of the original manuscript.