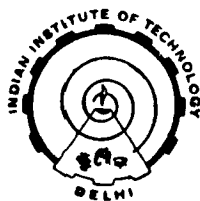


**FOURIER METHODS IN GENERATION SYSTEM
RELIABILITY EVALUATION AND
PRODUCTION COSTING**

by
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A thesis submitted to the
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for the award of the degree of
DOCTOR OF PHILOSOPHY



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INDIAN INSTITUTE OF TECHNOLOGY, DELHI
APRIL 1988

CERTIFICATE

Certified that the thesis entitled "Fourier Methods in Generation System Reliability Evaluation and Production Costing" which is being submitted by Shri Prabhat Mohan in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy in the Centre of Energy Studies of the Indian Institute of Technology, Delhi, is a record of the student's own work carried out by him under our supervision and guidance. The matter embodied in this thesis has not been submitted for the award of any other degree or diploma.

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To
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ABSTRACT

For power system planning and scheduling, the reliability evaluation and production costing of a power generation system are useful exercises. These are done by probabilistic simulation of power system operation. Since the load on a power system is known probabilistically, and the availability of generating plant is also known probabilistically, the probabilistic simulation of operation yields satisfactory results.

Two very common indices used in the reliability analysis of power generation systems are the loss of load probability and the expected value of energy not served. A new, robust, and computationally efficient Fourier method for evaluating the loss of load probability and expected value of energy not served in a generation system has been developed. An efficient algorithm is developed for computing the transformed probability density function of outages of all the generating units of the system. This algorithm fully exploits the simplicity in shape of the individual outage density functions. The fast Fourier transform algorithm is used for transforming the load duration curve, and for inverse transformation of the product of the transformed outage function and the transformed load duration curve, which is the equivalent load duration curve.

By production costing methods the energy expected to be generated by generating units, which have been committed in their merit

order, is calculated. The load on the system and the availability of generating units have to be known probabilistically for the expected production of energy to be quantified. Two new Fourier domain methods have been proposed. The first method is accurate. It uses the fast Fourier transform algorithm for inverse transformation of the equivalent load duration curve. The second method uses an approximation and is computationally very fast. This method does not include inverse transformation, and areas are computed directly in the Fourier domain corresponding to areas in the capacity domain.

The proposed methods being Fourier domain methods, significant saving in computational effort results for systems with identical generating units. The application of the methods is illustrated on some typical medium-sized example systems.

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