

PROBABILITY AND STATISTICS IN TECHNICAL ENGINEERING

ABSTRACT

The book introduces the essential elements of the probability theory and those of statistics. The main goal is to clarify the basic concepts, approached with emphasis on the application side and less on mathematical theory. Those presented in the book are addressed primarily, but not exclusively, to students with technical specializations, laying the practical foundations of their training, but it also can serve as starting point for in-depth theoretical studies in this field.

The first chapter of the book defines the event and presents the operations with events, these concepts being clarified by the examples of dice throwing and that of shooting at a target.

The second chapter introduces the concept of random event and that of the probability. The third chapter is focused on the random variables and their characterization. This chapter introduces some fundamental terms such the probability density function and the cumulative distribution function, expected value and variance.

The fourth chapter presents the practically most important distributions, these being illustrated by easy-to-follow examples done in Excel. Among these distributions are included the most important discrete and continuous distributions, such as the binomial distribution, the hypergeometric distribution and the normal one. There are also included those used to model the distribution of the extrema of various random phenomena.

The fifth chapter introduces the multidimensional distributions. The theoretical concepts are applied in practice through some simple examples. Thus, the case of independent variables is exemplified by the practical problem of load-strength relation in structure's design. The aspects and concepts regarding the case of dependent variables are illustrated by an example using a not too complicated bivariate distribution function.

The thematic of the sixth chapter is the statistical processing of experimental data. The theoretical concepts are applied in some examples taking some simulated random data as the input values in this calculations. The average and the empirical variance are computed, the confidence intervals are established, after then various statistical tests are performed.

In the seventh chapter the stochastic processes are introduced and their main statistical characteristics are described. Markov chains, which underlie the theory of these processes, are presented by a simple discrete example. Markov processes with the continuous variable are not detailed, because they cannot be treated at an elementary level.