Preface

The Phase-Locked Loops are electronic systems which have numerous applications, such as synchronized oscillators, dividers or multipliers of frequency, modulators or demodulators and amplifiers of phase modulated signals.

This book is devoted to the study of nonlinear dynamics described by classical equations of these systems. Different mathematical models are discussed: continuous-time and discrete-time systems of the first and second order. Differential or recurrence equations of phase loops depend on parameters, mainly on the frequency and amplitude of the input signal. Particular attention is paid to investigate how these parameters influence the occurrence of various types of stable periodic output signals. Much space is devoted to the chaotic oscillations appearing in the system. It is not our purpose to study various schemes and applications of phase loops because these problems have already a rich literature. This book draws the attention of the reader to nonlinear physical phenomena which cannot be explained by approximate theory which uses linearized or averaged equations. Phase loops have rich dynamics, probably more exciting than Chua's circuit or Lorenz equations. Selected mathematical methods (theory of one-dimensional mapping of the circle, integral manifolds, bifurcation theory and other) are presented and applied to explain the qualitative properties of nonlinear oscillations.

This book is addressed to postgraduate students, researchers in nonlinear science and mathematically inclined engineers interested in dynamical phenomena, particularly in the phenomena of deterministic chaos.

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