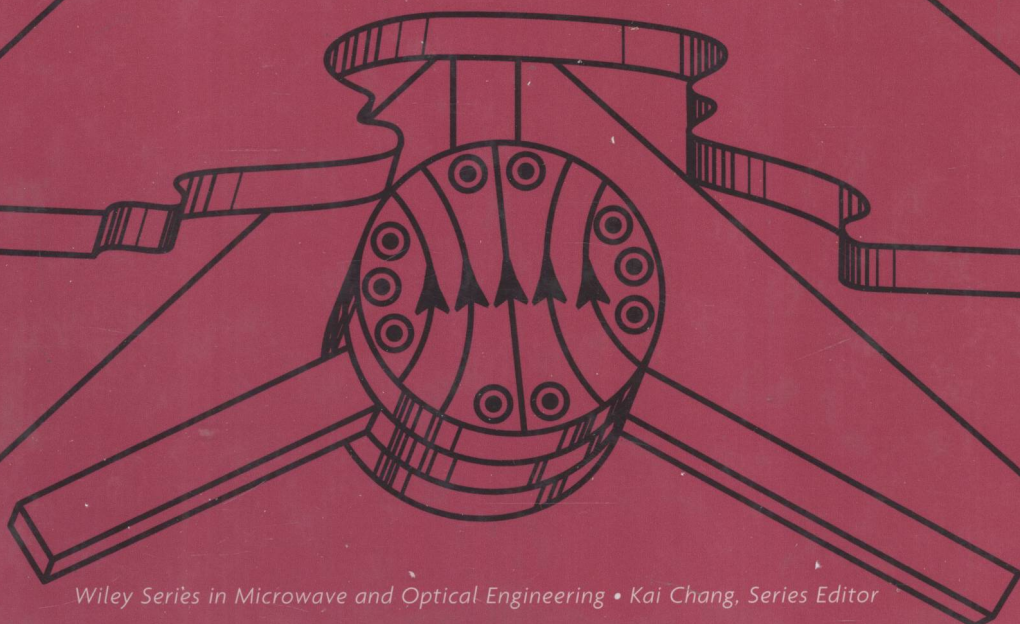


# THE STRIPLINE CIRCULATOR

THEORY AND PRACTICE

JOSEPH HELSZAJN



*Wiley Series in Microwave and Optical Engineering • Kai Chang, Series Editor*

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# The Stripline Circulator

Theory and Practice

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By

J. HELSZAJN



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# The Stripline Circulator

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# Preface

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The stripline junction circulator is a unique nonreciprocal device, which is embodied in many pieces of microwave equipment. The text is devoted to the theory and practice of this class of circulator. It starts with a chapter on the architecture of stripline circulators, and chapters on the tensor permeability in a magnetic insulator, and on the spatial shape demagnetizing factors of magnetic insulators. It continues with chapters on the scattering, eigenvalues, and admittance descriptions of the circulator as well as on its degree-1 and degree-2 one-port circuits. These chapters embody various classic experimental procedures for the characterization of the classic circulator. It proceeds with a block of chapters dealing with properties of gyromagnetic planar cloverleaf, wye, irregular hexagonal, and triangular resonators and the use of magnetic walls. The lumped element single junction circulator is dealt with as a preamble to dealing with the distributed circulator in that it embodies all the theoretical considerations of the general problem. Synthesis of the classic junction using a disk resonator is dealt with separately, as is the important Green's function and the finite element method. Special attention is devoted throughout to bridging the gap between its circuit and electromagnetic descriptions. These chapters are followed by one that deals with circulators employing triangular and irregular hexagonal gyromagnetic resonators. A separate chapter provides a detailed investigation of the frequency responses of the classic circulator using very weakly, weakly, strongly, and very strongly magnetized disk resonators. Still another chapter is devoted to the theory of the negative permeability circulator. The text continues with two chapters on circulators using wye resonators and a chapter on the little understood four-port single junction. A block of three chapters deals with the synthesis problem and the frequency responses of reciprocal and nonreciprocal junctions. The last two chapters but one are devoted to the fabrication of UHF and microstrip circulators. The last chapter deals with some discrepancies between idealized or theoretical models and



practice. A number of important topics such as spinwave instabilities and nonlinear effects in magnetic insulators have been omitted from the text in order to keep what is already a large volume in check. These topics are in every case already in place in a number of classic textbooks. Inevitably, some works, which have appeared elsewhere, have been duplicated for the sake of understanding.

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