
Preface

The properties and physics of spin waves comprise an unusually rich area of research. Under the proper circumstances, these waves can exhibit either dispersive or non-dispersive propagation, isotropic or anisotropic propagation, non-reciprocity, inhomogeneous medium effects, random medium effects, frequency selective nonlinearities, soliton propagation, and chaos. This richness has also led to a number of proposed applications in microwave and optical signal processing, and spin wave phenomena are becoming increasingly important to understand the dynamics of thin-film magnetic recording heads.

The book can be divided into three major parts. The first is comprised of Chapters 1–3 and is concerned with the physics of magnetism in magnetic insulators. The principal goals of these chapters are to provide a basic understanding of the microscopic origins of magnetism and exchange-dominated spin waves, motivate the equation of motion for the macroscopic magnetization, and to construct appropriate susceptibility models to describe the linear responses of magnetic materials to magnetic fields. The second part, Chapters 5–8, focuses on magnetostatic modes and dipolar spin waves, their properties, how to excite them, and how they interact with light. Chapter 4 serves as a bridge between these two parts by discussing how the susceptibility models from Chapter 3 can be used with Maxwell’s equations to describe electromagnetic and magneto-quasi-static waves in dispersive anisotropic media. Finally, Chapters 9 and 10 treat nonlinear phenomena and advanced applications of spin wave excitations.

The problems at the end of each chapter are often used to expand the material presented in the text. To enhance the book’s usefulness as a reference, many of these problems are “show that” problems with the answer given. For example, although the text discussion of dipolar spin waves in Chapter 5 is limited to an isolated film without a ground plane, the dispersion relations in the presence of a ground plane are given in the problems at the end of the chapter.

The book represents a major expansion of the classical, linear treatment of magnetostatic excitations contained in the earlier volume, *Theory of*

Magnetostatic Waves. Major additions include quantum mechanical treatments of angular momentum, exchange, and spin waves; nonlinear phenomena such as solitons and chaos; and applications such as the generation of spin waves using current-induced spin torques.

This book has been fun to write. We hope you find it to be an interesting and useful introduction to spin waves and their applications.

Daniel D. Stancil
Pittsburgh, USA

Anil Prabhakar
Chennai, India

August 2008



<http://www.springer.com/978-0-387-77864-8>

Spin Waves

Theory and Applications

Stancil, D.D.; Prabhakar, A.

2009, XII, 348 p. 20 illus., Hardcover

ISBN: 978-0-387-77864-8