Preface

These are the lecture notes used in two courses I have offered in the past ten years at Sharif University of Technology, namely *Advanced Electromagnetics and Scattering Theory*. These courses are usually taken by the first- and second-year graduate students in the communications group. The prerequisite for the sequence is vector calculus and electromagnetic fields and waves. Some familiarity with Green's functions and integral equations is desirable but not necessary.

This manuscript is meant to provide a brief but concise introduction to classical topics in the field. It is divided into two parts including annexes. Part I covers principles of *Electromagnetic Theory*. The discussion starts with a review of the Maxwell's equations in differential and integral forms and basic boundary conditions. The solution of inhomogeneous wave equation and various field representations, including Lorentz's potential functions and the Green's function method, are discussed next. The solution of Helmholtz equation and wave harmonics follow. Plane wave propagation in dielectric and lossy media and various wave velocities are presented next. This part concludes with a general discussion of planar and circular waveguides.

Part II presents basic concepts of electromagnetic *Scattering Theory*. After a brief discussion of radar equation and scattering cross-section, we review the canonical problems in scattering. These include the cylinder, the wedge, and the sphere. The edge condition for the electromagnetic fields in the vicinity of geometric discontinuities are discussed. We also present the low frequency Rayleigh and Born approximations. The integral equation method for the formulation of scattering problems is presented next, followed by an introduction to scattering from periodic structures.

In preparing these notes, I have benefited from the contribution of two respectable groups of individuals. First, I have been fortunate enough to learn electromagnetic theory under a number of distinguished scholars at The University of Michigan. I am indebted to Profs. Chen-To Tai, Dipak Sengupta, and Thomas B. A. Senior. I am also thankful to my research advisor at Radiation Laboratory, Prof. John L. Volakis. I have been influenced directly by their style of approach, although

all the shortcomings and mistakes which may be encountered in this work are those of mine.

Next, I am indebted to my students at Sharif University of Technology whose enthusiasm has contributed significantly to the refinement of my original notes.

Tehran, Iran, December 2002 Kasra Barkeshli

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