Electromagnetic Scattering by Basic, Canonical and Complex Radar Targets Using GO, PO, Modal Methods, and GTD/UTD

by

Constantine A. Balanis
School of Electrical, Computer and Energy Engineering
Arizona State University
Tempe, AZ 85287-5706

Abstract

The fundamentals of electromagnetic scattering by basic, canonical and complex targets will be reviewed and applied using Geometrical Optics (GO), Physical Optics (PO), Modal Methods (MM), and Geometrical/Uniform Theories of Diffraction (GTD/UD). The targets examined will be strips, plates (rectangular and circular), circular cylinders, spheres, wedges and corner reflectors. The primary sources of radiation will be electric and magnetic line sources, and uniform plane waves. The monostatic and bistatic scattering widths (SW) of two-dimensional targets and the radar cross sections (RCS) of three-dimensional targets will be defined as the ratio of the scattered field in the presence of the target over the incident field in the absence of the target. The GTD will be introduced as an extension of the scattering by a two-dimensional perfect electric conducting (PEC) wedge. Using the Method of Steepest Descent (MSD) the total field scattered by the wedge can be decomposed into Geometrical Optics (GO) field and diffracted field. The GTD diffracted field exhibits singularities along the Incident (ISB) and Reflection (RSB) Shadow Boundaries, and the fields are not accurate along the respective Transitions Regions (TRs). The UTD is an extension of GTD which removes the GTD singularities along the incident (ISB) and reflection (RSB) shadow boundaries and improves the diffracted field along the corresponding transition regions (TRs).

Most of the material presented will be from Chapters 6, 7, 11 and 13 of the book *Advanced Engineering Electromagnetics* (2nd edition, 2012) by Constantine A. Balanis (2nd edition, 2012, Wiley), a copy of which will be provided to each attendee as part of the registration for the course.