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« Fundamentals of the Physical Theory of Diffraction »

Annotation

Physical Theory of Diffraction (PTD) was originated by this author for investigation of radiation and scattering of *high frequency* acoustic and electromagnetic waves. This course presents basic ideas and results of the modern form of PTD. With appropriate modifications it can be utilized for the solution to many practical problems. Among them are the design of microwave antennas, mobile radio communication, construction of acoustic barriers to decrease a noise level, evaluation of radar cross sections for large objects (tanks, ships, missiles, etc.). In particular, PTD was successfully applied in the design of American stealth-fighter F-117 and stealth-bomber B-2 with low radar visibility.

PTD is based on fundamental principles of equivalency and localization. According to the equivalency principle, a scattered field is considered as radiation generated by equivalent sources induced by an incident wave on an object surface. The localization principle is used to establish high-frequency approximations for the equivalent sources. After that, work consists of an asymptotic evaluation of the field integrals and analyzing the physical structure of the scattered field. Explicit expressions are derived for reflected and diffracted rays and beams, for the field in the vicinity of foci and caustics.

This course studies diffraction of acoustic and electromagnetic waves on *perfectly reflecting objects*. In acoustics these objects are described by the Dirichlet and Newman boundary conditions. In electromagnetics they are modeled by perfectly conducting bodies. Analytical study is complemented by the results of numerical calculation. *Equivalency relationships* are established between diffraction fields in acoustics and electromagnetics. Lectures are followed by assignments for independent investigation by students.

Following monographs serve as textbooks:

- P.Ya. Ufimtsev, «Theory of Edge Diffraction in Electromagnetics» (Tech Science Press, Encino, California , 2003)
- P.Ya. Ufimtsev, «Fundamentals of the Physical Theory of Diffraction» (John Wiley & Sons, Inc., New Jersey, 2007)

This course is intended for PhD students and researchers studying the wave phenomena in such disciplines as electromagnetics, acoustics, mathematical physics, mobile and satellite communication, stealth-technology etc..