
Short Course SC001

Asymptotic High Frequency Methods in Electromagnetics

Prof. Ivan Andronov, Dr. Frédéric Molinet

Tuition Fee : USD 150

Date : 21 MAY, 2017

Course Objective :

Asymptotic high frequency methods remain an important tool for the analysis and understanding of the physical phenomena occurring in diffraction, radiation and propagation of waves. Despite the progress in numerical techniques, asymptotic methods remain still useful not only for the computation of the Radar Cross Section of targets the dimensions of which are very large compared to the wavelength and for the interaction of the field radiated by an antenna with obstacles in a complex or extended environment but also for the construction of macro-basis functions founded on the physical properties of the field in the neighborhood of a surface or of its singularities. The short course which we propose has been conceived in order to guide progressively the participants from basic concepts to the most recent developments.

Who Should Attend :

Students, postdocs and antenna engineers having a general basis in electromagnetics and who want to complete their knowledge and augment their investigation possibilities in the development of new methods for solving the Maxwell equations.

Course Outline

1. Introduction to GTD (F. Molinet)

- Fundamentals on asymptotic expansions
- Asymptotic solutions of the Maxwell equations in free space
- Derivation of the laws of Geometrical Optics (GO)
- Derivation of the laws of Geometrical Theory of Diffraction (GTD) by edge singularities, Keller's cone, canonical problems.

2. Boundary Layer Method (I. Andronov)

- Parabolic equation method
- Asymptotic representation of the field in Fock domain
- Creeping waves
- Friedlander-Keller solution

3. Diffraction by the edge of a wedge : non uniform and uniform solutions (F. Molinet)

- Straight perfectly conducting wedge
- Curved perfectly conducting wedge

4. Diffraction by elongated bodies – Part 1 (I. Andronov)

- What is wrong with classical results in the case of diffraction by elongated bodies
- Moderately and Strongly elongated surfaces
- Scalar waves diffraction by a Strongly elongated spheroid, Forward and Backward waves
- Far field asymptotics

5. Diffraction by elongated bodies – Part 2 (I. Andronov)

- Diffraction of electromagnetic waves by a Strongly elongated spheroid
- Diffraction by elliptic cylinder and by a strip

6. Hybrid diffraction coefficients and asymptotic currents (F. Molinet)

- Edge excited creeping waves on a convex surface
- Asymptotic currents on a 2D smooth convex surface
- Asymptotic currents on a 2D convex surface delimited by sharp edges

7. Conclusion and new trends in asymptotic high frequency methods (I. Andronov)

Instructors Biography :

Prof. Andronov has got First degree diploma from the faculty of Physics of Leningrad (now St.Petersburg) State University in 1987 and PhD degree in Mathematical Physics in 1991. In 1993 he worked as a researcher at the Université Bordeaux-1 and then collaborated with CEA on a number of Contracts. Many times he was a visiting Professor at ENS-Cachan, France. He was the member of the organizing committee of URSI EMTS in 1995, won several Young Scientists awards from URSI. He is the author of two books : Generalized point models in structural mechanics, published by World Scientific in 2002, and Asymptotic and Hybrid Methods in Electromagnetics co-authored with F.Molinet and D.Bouche and published by The IET in 2005. Now Ivan Andronov is a professor at the Department of Computational Physics of St.Petersburg State University. He is a member of the organizing committee of the Annual International Conference "Days on Diffraction" and the General Chair of PIERS 2017 in St.Petersburg.

Dr. Molinet was the head of the Department of Theoretical Studies and Modeling of the Laboratoire Central de Télécommunications (LCT) in Paris before founding his own company MOTHEMIM where his activities are focused on numerical and asymptotic solutions of electromagnetic and acoustic radiation and scattering problems. Prior to joining LCT, he was involved in research in theoretical nuclear physics at the University of Strasbourg (where he got the "Dr de 3^e cycle degree" in Quantum Mechanics) and in plasma physics at the Institut Henri Poincaré in Paris (where he got the "Doctor-es-Sciences degree" in Theoretical Physics). He is the coauthor of the two books : Asymptotic Methods in Electromagnetics, published by Springer in 1997 and Asymptotic and Hybrid Methods in Electromagnetics in the IEE Electromagnetic waves series, published in 2005 and the author of the book : Acoustic High Frequency Diffraction Theory, published by Momentum Press in 2011. He was chairman of the National Radio Science Committee of Commission B of URSI and the recipient of the Science and Defense Award of the French Ministry of Defense.