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בית הספר להנדסת חשמל ואלקטרוניקה
המחלקה לאלקטרוניקה פיסיקלית

פרופ' בן ציון שטיינברג

Course # 0510.6802

Spectral Methods for Excitation and Radiation of Fields and Waves

Course plan

1. Derivation of the basic equations governing the radiation from sources in a layered medium (2 meetings)
    a. Scalarization of the field equations
    b. One-dimensional transmission-line equations
    c. The 2D spectral integral and its reduction with the Fourier-Bessel transform

2. A source in the presence of a dielectric half-space (2 meetings)
    a. Spectral representations in 2D, 3D, and the passage to 2.5D via the FBR
    b. Analytic properties in the complex spectral plane and angular spectrum plane
3. Asymptotic evaluation of integrals and spectral plane implementation (2 meetings)
    a. Identification of analytic properties
        i. Saddle point contribution
        ii. Contributions from singular points: poles and branch cuts
    b. Interpretation of the various contributions as different wave phenomena.
        i. Wave phenomena – transmitted and reflected waves, the Head wave.
        ii. Canonical representations
    c. Home assignment: Transmitted field in 2D, and 3D problem via the FBR

4. Strum-Liouville theory (2 meetings)
    a. The set of eigenfuctions and eigenvalues. Discrete spectrum. Continuous spectrum
    b. Characteristic Green's function and the construction of the complete spectrum
    c. Completeness relations
    d. Green's function alternative representations
5. Parallel planes waveguide (2 meetings)

    a. Alternative representations – modes and rays

    b. Hybrid Ray-Mode representations

    c. The dielectric waveguide and generalization to multilayer media

    d. Home assignment

6. Continuous layered medium (2 meetings)
   a. The mapping to canonical equations (WKB and its generalization) and rays interpretation
   b. Bremmer series

7. Electrically small scatterers in layered media (?) (1 meeting)

Bibliography

[1] L.B. Felsen and N. Marcuvitz, *Radiation and Scattering of Waves*, Prentice Hall N.J. 1973 (reissued by IEEE Press series on Electromagnetic Wave Theory).

[2] Weng C. Chew, *Waves and Fields in Inhomogeneous Media*, Van Nostrand Reinhold, N.Y. 1990 (reissued by IEEE Press series on Electromagnetic Wave Theory).

[3] A. Ishimaru, *Electromagnetic Wave Propagation, Radiation, and Scattering*, Prentice Hall N.J. 1991.

[4] Course booklet – available for download in the course site in moodle.