

DRIEI

PhD Program in Electronic and Computer Engineering

University of Cagliari, Italy

Seminar:

Near-field focusing, Bessel beams and localized pulses: fundamentals and engineering applications.

Instructor: Prof. Santi Concetto Pavone - University of Catania.

SSD: IINF-02/A (Electromagnetic Fields).

Credits / hours: 1 credit / 10 hours.

Language: English.

Scheduling: During the week 10-14 February 2025.

Final Evaluation: Written.

Website:

Goal of the Seminars:

In the last decades, increasing interest has been gained by antennas and, more in general, by radiating systems operating in the Fresnel region, with respect to more traditional applications in the far field. Aim of the seminar is to introduce basic concepts on beam shaping techniques in the near-field region, and to specialize on fundamentals of nondiffractive Bessel beam launcher theory and design at microwaves and millimeter waves. Attention will be paid to relevant engineering applications, spanning from focusing (i.e., lensing) to wireless power transfer maximization in the near field beyond layered media. Finally, an introduction to localized EM pulse generation and propagation will be presented.

Prerequisites:

Foundations of electrodynamics and electromagnetics engineering.

Intersection with other courses/seminars at the University of Cagliari

There is no significant overlap with other courses/seminars offered by the PhD programme DRIEI and in Master's Degrees at UniCA.

Outline:

- Review of radiation theory and radiative near-field region.
- Overview of some near-field focusing techniques.
- Introduction to nondiffractive beams.
- Bessel beam theory and applications.
- Longitudinal and transverse Bessel beam launchers at microwaves/millimeter waves.
- Bessel-shaped beam maximum power transfer beyond a stratification.
- Review of localized pulses and X-waves.
- X-wave generation by Bessel beam launchers.
- Future perspectives and more advanced techniques.