ROYAL INSTITUTE
OF TECHNOLOGY

School of Electrical Engineering and Computer Science

EI2400 Applied Antenna Theory

2024 – Suggested projects

Projects

- Same groups as in the computer (and hands-on) labs.

- You will thoroughly study and design one specific advanced antenna with:
  - Theory.
  - Simulation.
  - Measurements (depending on the project).

- June 3rd (10:00-13:00 in Ivar Herlitz), you will present your design with a set of slides:
  - Maximum 15 slides.
  - Maximum 10 min for the presentation.
  - Summarize the most important points of your design, as well as difficulties that you found.

Project 1 (Jesus)

- To design a gap waveguide slot array:
  - The antenna operates at 40 GHz.
  - The EBG structure is of pin-type.
  - The design is fully metallic.

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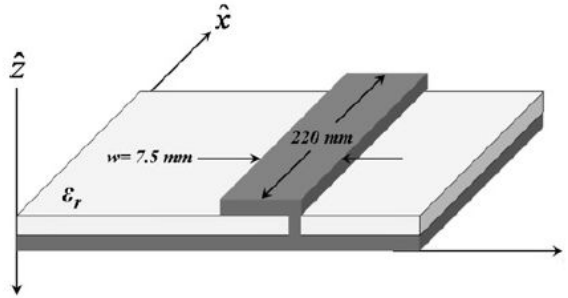
- Steps:

1. Study the literature and review how gap waveguides and slot arrays operate:

   Z. Shaterian, A. K. Horestani and J. Rashed-Mohassel, "Design of slot array antenna in groove Gap waveguide technology," in *IET Microwaves, Antennas & Propagation*, vol. 13, no. 8, pp. 1235-1239, 3 7 2019.

2. Design the antenna with simulations in CST.

Project 2 (Hairu)

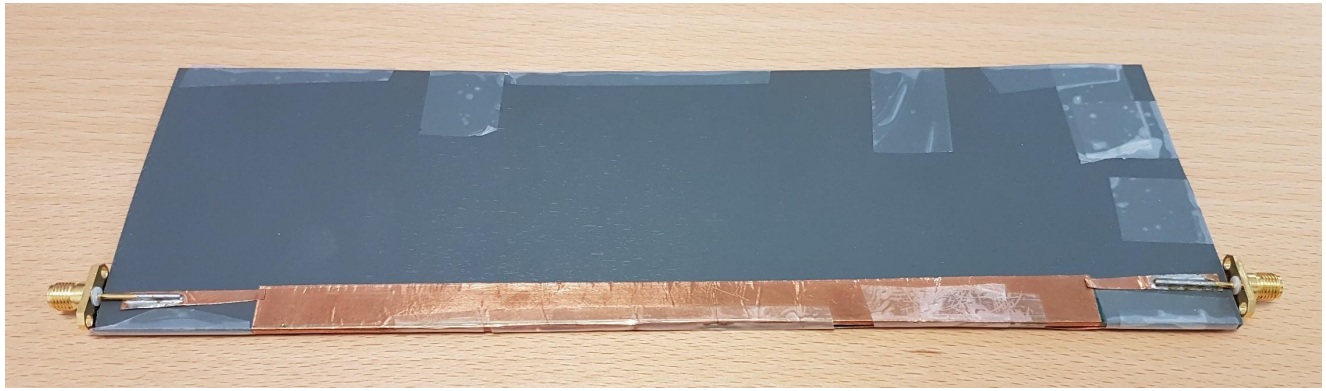


- To design a half-width leaky wave antenna in microstrip technology at around 5 GHz.
- Steps:

1. Read the following paper about half-width leaky wave antennas:

   G. M. Zelinski, G. A. Thiele, M. L. Hastriter, M. J. Havrilla and A. J. Terzuoli, "Half width leaky wave antennas," in *IET Microwaves, Antennas & Propagation*, vol. 1, no. 2, pp. 341-348, April 2007.

2. Check commercially available materials.
3. Design the antenna with simulations in CST and manufacture in the lab.



Project 3 (Nuria)

- To design a dual band micro-strip patch antenna with two different radiation patterns: Azimuthal at 2 GHz and broadside at 3 GHz.
- Steps:

1. Study the literature and to review how the TM_{10} and TM_{11} (circular patch nomenclature) operate:

V. Gonzalez-Posadas, D. Segovia-Vargas, E. Rajo-Iglesias, J. L. Vazquez-Roy and C. Martin-pascual, "Approximate analysis of short circuited ring patch antenna working at TM_{01} mode," in *IEEE Transactions on antennas and Propagation*, vol. 54, no. 6, pp. 1875-1879, June 2006.

2. Check commercially available materials.
3. Design the antenna with simulations in CST and measure it in the lab.

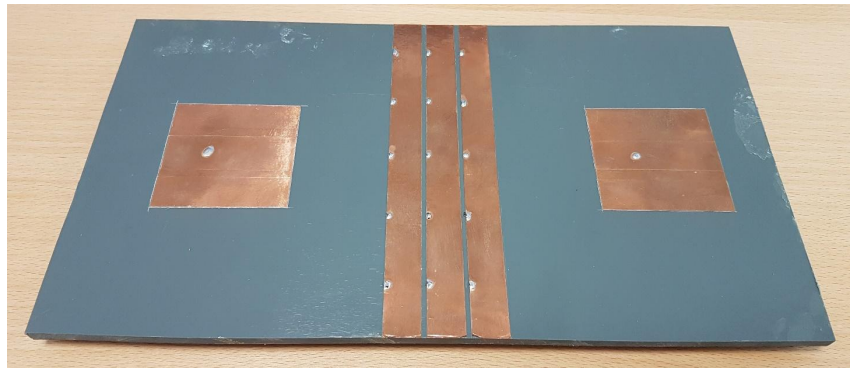
Project 4 (Moises)

- To design a soft surface for mutual coupling reduction between two patch antennas: Reduce the coupling between two patch antennas operating at 4 GHz using a strip-type soft surface.
- Steps:

1. Study the literature and review how soft surfaces operate and how they can be realized in practice:

E. Rajo-Iglesias, M. Caiazzo, L. Inclan-Sanchez, and P.-S. Kildal , "Comparison of bandgaps of mushroom-type EBG surface and corrugated and strip-type soft surfaces," in *IET Microwaves, Antennas and Propagation* , vol. 1, no. 1, pp. 184-189, February 2007.

2. Check commercially available materials.
3. Design the antenna with simulations in CST and manufacture it in the lab.



Project 5 (Mingzheng)

- To design a 3-dimensional Luneburg lens antenna using a periodic structure: The lens operates at 30 GHz and uses $4\lambda_0$ in diameter. The refractive index is realized with a periodic array of cubic holes in a host medium.

- Steps:
  1. Study the literature and review how Luneburg lenses operate:

Y. Li, L. Ge, M. Chen, Z. Zhang, Z. Li, and J. Wang, "Multi-Beam 3D Printed Luneburg Lens Fed by Magneto-Electric Dipole Antennas for Millimeter-Wave MIMO Applications," in *IEEE Transactions on Antennas and Propagation*, vol. 67, no. 5, pp. 2923-2933, May 2019.

  2. Check commercially available materials.
  3. Design the antenna with simulations in CST and manufacture it in the lab.