

Emerging device technologies

The Research Group

The Emerging Device Technology (EDT) Research Group is composed of researchers whose interests are based around the theme of materials and devices in general.

There is a solid research base with its staff having many years experience in superconducting, insulating and semiconducting materials. The research includes the basic science of materials, characterisation and production of materials for applications and the demonstration of applications themselves.

This potentially wide area of research is limited by the choice of materials to be investigated, which is governed by the extensive knowledge in the centre for the requirements of modern technology. [Learn more about the group. \(/research/activity/eece/systems-devices/edt/people-facilities.aspx\)](/research/activity/eece/systems-devices/edt/people-facilities.aspx)

The Research

The EDT group has developed out of a strong research program on superconducting and semiconducting materials. Superconductors have been studied for over a decade with well over one hundred publications on the physics, material science and application of these exotic materials.

The applications have primarily been for communication and radar systems with a number of new microwave devices, circuits and systems being developed. A comprehensive book [1] has been written on superconductors at microwave frequencies by the head of the research centre. There is also work on Josephson devices as well as interfaces between electronic and the nervous system.

Examples of Research (PDF files)

- [Delay Lines \(PDF 95 KB\) \(/Documents/college-eps/eece/research/EDT/Delay.pdf\)](/Documents/college-eps/eece/research/EDT/Delay.pdf)
- [Delay Line Filter \(PDF 75 KB\) \(/Documents/college-eps/eece/research/EDT/Delay-Filters.pdf\)](/Documents/college-eps/eece/research/EDT/Delay-Filters.pdf)
- [Focal Plane Arrays for Radio Astronomy \(PDF 143 KB\) \(/Documents/college-eps/eece/research/EDT/focal.pdf\)](/Documents/college-eps/eece/research/EDT/focal.pdf)
- [HTS Coplanar Left-Handed Transmission Lines and Resonators \(PDF 117 KB\) \(/Documents/college-eps/eece/research/EDT/coplanar.pdf\)](/Documents/college-eps/eece/research/EDT/coplanar.pdf)
- [Josephson Devices \(PDF 93 KB\) \(/Documents/college-eps/eece/research/EDT/josephson.pdf\)](/Documents/college-eps/eece/research/EDT/josephson.pdf)
- [Micromachined Membrane Devices \(PDF 61 KB\) \(/Documents/college-eps/eece/research/EDT/micromachined.pdf\)](/Documents/college-eps/eece/research/EDT/micromachined.pdf)
- [Micromachined Microwave Circuits \(PDF 97 KB\) \(/Documents/college-eps/eece/research/EDT/microwave.pdf\)](/Documents/college-eps/eece/research/EDT/microwave.pdf)
- [Microwave Characterisation of Ferroelectric Thin Films \(PDF 121 KB \(/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf\)\)](/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf)
- [Microwave Microscopy \(PDF 81 KB\) \(/Documents/college-eps/eece/research/EDT/MicrowaveMicroscopy.pdf\)](/Documents/college-eps/eece/research/EDT/MicrowaveMicroscopy.pdf)
- [MRI Coils \(PDF 68 KB\) \(/Documents/college-eps/eece/research/EDT/MRI.pdf\)](/Documents/college-eps/eece/research/EDT/MRI.pdf)
- [Neuroelectronic Interfaces \(PDF 53 KB\) \(/Documents/college-eps/eece/research/EDT/neuroelectronic.pdf\)](/Documents/college-eps/eece/research/EDT/neuroelectronic.pdf)
- [Superconducting Antennas \(PDF 100 KB \(/Documents/college-eps/eece/research/EDT/antenna.pdf\)\)](/Documents/college-eps/eece/research/EDT/antenna.pdf)
- [Superconducting Micromachined Microwave Devices \(PDF 92 KB\) \(/Documents/college-eps/eece/research/EDT/SuperconductingMicrowave.pdf\)](/Documents/college-eps/eece/research/EDT/SuperconductingMicrowave.pdf)
- [Superconducting Microwave Circuits \(PDF 92 KB\) \(/Documents/college-eps/eece/research/EDT/SuperconductingMicrowave.pdf\)](/Documents/college-eps/eece/research/EDT/SuperconductingMicrowave.pdf)
- [Superconductors at Microwave Frequencies \(PDF 177 KB\) \(/Documents/college-eps/eece/research/EDT/MicrowaveFrequencies.pdf\)](/Documents/college-eps/eece/research/EDT/MicrowaveFrequencies.pdf)
- [Superconductors in Radio Astronomers \(PDF 98 KB\) \(/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf\)](/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf)
- [Thick Film Ferroelectric Phase Shifters \(PDF 98 KB\) \(/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf\)](/Documents/college-eps/eece/research/EDT/FerroelectricPhaseShifters.pdf)
- [Thin Film Development \(PDF 100 KB\) \(/Documents/college-eps/eece/research/EDT/ThinFilm.pdf\)](/Documents/college-eps/eece/research/EDT/ThinFilm.pdf)
- [Thin Film Ferroelectric Tunable Microwave Devices \(PDF 16 KB\) \(/Documents/college-eps/eece/research/EDT/ThinFilmDevices.pdf\)](/Documents/college-eps/eece/research/EDT/ThinFilmDevices.pdf)

Facilities

The group is now very multi-disciplinary in nature, and a large class 10,000 clean room facility (54m²) enables the production of a number of materials for application in microwave circuits. In addition to the sputtering of high quality superconductors, the centre produces ferroelectric, dielectric and metal thin films for research.

These materials are optimised for use in a number of microwave circuits including tuneable filters, duplexers, delay lines, antennas and other passive signal processing circuits. This work has led to the publication of a book on microwave filters [2] as well as several patent applications. There is also work on a number of novel microwave structures using micromachining techniques for application in the frequency range 1-110GHz.

In addition to device work the centre has been working on a superconductor receiver system for mobile communication base stations with a number of European collaborators. The system has been tested in Portugal by the operator TMN with considerable success.

Read about our [manufacturing and device fabrication facilities \(/research/activity/eece/systems-devices/edt/facilities.aspx\)](/research/activity/eece/systems-devices/edt/facilities.aspx).

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Referenced publications

[1] Lancaster M. J. "Passive microwave device applications of high temperature superconductors" Cambridge University Press, Cambridge UK 1997

[2] Hong J.-S. and Lancaster M. J. 'Microstrip filters for RF/microwave applications' John Wiley and Sons Inc. 2001 ISBN 0-471-38877-7