

MASTER'S THESIS INTERNSHIP OFFER

DESCRIPTION

› **Title :** Development of radiofrequency switches based on ferrite materials for antenna reconfigurations

› **Hosting organization:** University of Limoges - Xlim Research Institute

› **Lab:** Xlim

› **Research Team:** Antennas and signals

› **Scientific pole:** RF systems

› **Starting date (month/date):** Can start from January or later

› **Short description of the internship offer (up to 5 sentences):**

A microwave circulator using ferrite elements can be converted into a fast acting microwave switch. Switching will be achieved by a single current pulse which will reverse the magnetisation of the ferrites, which will remain permanently magnetised in this new state. These switches are particularly interesting for civil, space or military applications as it will allow the development of the multi-function device on the same ferrite substrate without having to carry over any components. More specifically, one of the objectives is the joint development of an antenna array integrating upstream switches based on ferrite materials to achieve radiation pattern reconfigurability.

› **Objectives (up to 5 sentences):**

The general objective to be achieved during the thesis (which will follow the internship) is the development of an antenna array reconfigurable in radiation pattern by integrating ferrite switches. These switches will be realized as circulators that can be controlled by a current pulse that will reverse the magnetization of the ferrite. The use of ferrites for switches will provide fast switching times, high power switching, no holding current and therefore low power consumption.



› **Description of the internship offer:**

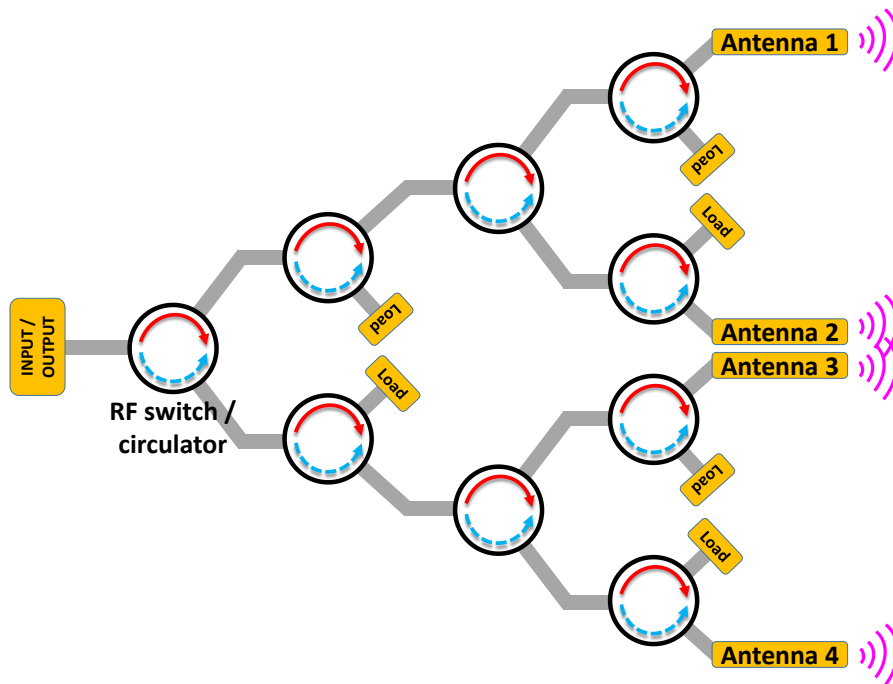
The objectives of this internship are multiple and are listed chronologically below:

-Development of a suitable circulator on any load: the operating principle of a ferrite-based switch relies on the design and chaining of circulators. The impedances at the input or output of the circulators can therefore be equal to 50Ω or complex and variable according to the frequency.

-Reversing the direction of circulation of circulators via an electrical control: The basic principle of this type of switch is based on the reversal of the direction of circulation which allows a switch between output 1 or output 2. Several steps will be necessary for this and we will start this study by a control of the direction of circulation with the help of a direct current circulating in coils positioned above and below the ferrite discs thus allowing the creation of a magnetic field applied to the ferrites and thus a circulation phenomenon. The final objective is the control of the magnetic field inversion by a simple electric pulse and the use of a remanent field which will polarize the ferrite discs.

-Development on a microstrip technology: The previous objectives will initially be developed in a stripline technology that we have now mastered for several years. However, in the interest of integration and miniaturization, we plan to develop this type of switches in microstrip technology. For this, we will use composite substrates made with ceramics and ferrites.

› **Photo (optional)**



› Description of the research team:

The thesis will be carried out within the antennas and signals team of the Xlim laboratory and supervised by L. Huitema and T. Monédière. It will be part of the INOGYRO joint laboratory (<https://inogyro.xlim.fr/>), which includes the Xlim laboratory and the SME Inoveos and in which 4 theses have already been completed or are in progress. The candidate will therefore benefit from the know-how and expertise developed by these two partners and from the dynamics of this joint laboratory.

SKILLS

› Expected skills of the applicant:

Knowledge of the basic notions concerning radio frequencies (S parameters. Use of Matlab. Knowledge of electromagnetic simulation software (CST or HFSS). Autonomous and dynamic.

PHD THESIS OPPORTUNITIES

› PhD thesis opportunity after the Master course:

Yes No

› If yes, financing already obtained:

Yes No

› If yes, what kind of funds: The thesis will be co-financed by the Ministry and the Nouvelle Aquitaine Region. The candidate will benefit from all the equipment of the laboratory: bench of measurements under points, anechoic chambers, access to the software of simulation (CST, Ansys, Matlab, etc...)

CONTACT & APPLICATION

› Surname and first name of the internship supervisor(s):

Laure Huitema and Thierry Monédière



› **Email of the supervisor(s):** laure.huitema@xlim.fr, thierry.monediere@xlim.fr

› **Phone number of the supervisor(s):** +33689251581

› **The application shall be sent to the email:** laure.huitema@xlim.fr

› **Closing date for applications:** 31 décembre 2022

