

Teaching & Research interests

Research interests

My research interests are related to Antennas and Propagation, especially in context of wireless communications systems. Currently, I focus my work on Wireless Ad Hoc Networks (WAHN).

Scenarios specification and mobility models definition:

My specifications include military-disaster recovery and conference-fair networks scenarios. I defined traffic types, capacity requirements, nodes density and mobility models. Some commonly used models such as Gauss-Markov Mobility, GMM; Reference Point (Velocity) Group Mobility, RPGM (RVGM) are not matched with realistic scenarios. This is why I try to make relevant models for a specified scenario. For example, I propose an extension of RVGM to take into account battle situation in military tactical ad hoc networks. I achieved a software, "SMGen" which generates scenarios with nodes trajectories as function of model and time.

Propagation modeling for Ad Hoc Networks:

The aim is to design a realistic propagation model that varies with time, frequency and space. Large-scale and small-scale phenomena are taken into account in WAHN context. Fading is fundamentally different in WAHN networks compared to cellular networks. A good example is Doppler spectrum. We will work to predict and estimate the channel variations to allow upper layers auto-configuration using a cross layer interface concept in the cognitive radio context.

Propagation and channels modelling for fixed and mobile wireless network:

I conduct different survey to have better understanding of propagation phenomena in millimetric frequencies, because this range is less investigated as of now. A resulting achievement is the following:

Using Ray tracing and site specific model, I achieved a deployment planning tool, LIBUS (Link Budget Simulator) for BFWA (Broadband Fixed Wireless Access) operating in millimetric frequency band. GIS (Geographic Information System) databases are used within the software to simulate realistic environments. I carried out several experimental measurements to validate the simulation results. This tool is used for coverage planning in French project, "ERASME: Évaluation de Réseaux d'Accès Sans fil Multimédia en EHF" and European program, "BROADWAN: Broadband services for everyone over fixed wireless access networks". All techniques (adaptative modulation, OFDM...) to improve the performances will be more investigated.

I'm thinking on the way to extend LIBUS software to WIMAX band in my future work.

New topology antenna design:

BFWA requires line-of-sight (LOS) conditions to have reliable links. Many problems occur when analyzing the coverage of BFWA on a real environment. A particular observation is shadowed zones dues to the used antennas which are directional in elevation plane. High gain antennas with specific pattern (for example, cosecant-squared antenna) will overcome this problem and drastically improve the coverage range.

Another challenge is to improve coverage percentage by using switch-beam or adaptative antennas. A typical percentage in urban environment is 60% and it will be increase up to 95%.

Related field to investigate:

I'm able to work in any other related fields in telecommunications communication systems. I'm willing to investigate MIMO (Multiple Input Multiple Output) system. It seems to be one of scientists' interests of the last five years. Even though some important works are already conducted, I think many challenges must be taken up either in antenna or propagation area.

Some of my research results are presented in international conferences and have chaired or co-chaired some conference programs.

Teaching interests

Having knowledge and capabilities is not efficient; mobilize them in a relevant way and in a singular context reveals your competences. It is what we try to inculcate to our students through teaching.

Courses:

My teaching experience includes 4 different courses in the areas of Programming, Telecommunication network systems and Physics.

Programming: Basic programming language, FORTRAN, MATLAB, JAVA with focus on object-oriented programming and Graphical User Interface.

Antenna and Propagation: Electric circuits, Electromagnetism, Channels analysis and Propagation, Overview of antennas theory and some specific antennas design.

Wireless systems and GIS: Broadband communication systems (wire and wireless), GIS integration in telecommunication software.

Physics (high school level): All the basics of physics (Mechanics, Electricity, Magnetism, Energetics...)

I have taught Chemistry as complementary course of Physics and I am able to teach some mathematics courses (Differential and integral calculus, linear algebra, vector analysis...)

Teaching strategy:

My teaching strategy, especially for graduate students, is to establish a close relationship research and education. For the undergraduate students, I privilege an approach based on the user-friendliness and the team work. I want to be sure that they have fun to learn their courses and to accomplish their Practical Work. However, they must learn to become self-started.

At any level, I encourage students to read scientific articles from the primary literature. On the basis of this initial comprehension, they will be able to ask good questions and formulate their own opinions which will be useful in their future work. I recommend this methodology in the students' projects I manage.

Some achievements:

I have supervised over ten final projects and training courses of students of Electrical and Telecommunication Engineering Department of Limoges University, France. I wrote a booklet on LMCS (Local Multipoint Communications System) for students use. I also planned remedial courses for the students in school difficulty.