Electromagnetics and Matter Group

Innovating with you while opening new routes within a technological ocean



We are a Group





The Electromagnetics and Matter Research Group (GEM) was created at the Polytechnic University of Cartagena in 2004 with members from this and other universities. Currently it is formed by four doctors in telecommunication engineering and three telecommunication engineers.

GEM is specialized in the study of communication and industrial systems with profitable characteristics thanks to the behaviour of the materials in the system with the electromagnetic radiation. Among these systems, we can list microwave heating processes, shielding of electronic equipment, constructive structures for minimizing the radar cross section or filtering or, in general, any process of energy transmission by means of electromagnetic waves.

Two main aspects for the study of this type of systems are an accurate knowledge of the electromagnetic properties of the materials that set up the system, and the use of electromagnetic simulation tools. In this sense, GEM has developed new techniques for dielectric characterization of materials and electromagnetic simulation software that allow the analysis and design of these systems as a previous stage to the manufacturing.

GEM has worked in a large number of projects related to this matter by means of both public and private funding, and the results have generated a great quantity of technical papers and conference contributions, and several industrial patents.

The target we are pursuing



Researching lines	Inspiration and development
Microwave heating	Our researching group offers consulting services in the analysis and systems design for microwave heating. Not only for static systems but also for batch or continuous processes with the aim of joining minimization of energy cost and optimal quality in the final product.
Application of numerical methods in electromagnetic problems	GEM has developed a set of electromagnetic simulation tools based on well- known numerical methods as mode-matching or finite elements. Currently we are working in the application of these techniques from the applicator (resonant cavity where the electromagnetic energy is transferred to the material) design to the design of filters or matching devices for avoiding leakage of radiation and improve the energy efficiency of microwaveovens.
Dielectric characterization of materials	At GEM we have the equipment for measuring the electric permittivity of biological, plastic (polymer), ceramic and liquid materials, independently of the final application of the material, in a 0 – 20GHz frequency range. The knowledge of these properties is very important for the operation of applications such us microwave heating, communications system designs and radar systems.
Intelligent materials against electromagnetic radiation	In some communication applications the emitter and/or receiver antenna must be protected from atmospheric conditions by means of radomes that, depending on the specific application, must also have a given frequency response. These radomes can be designed for obtaining an "intelligent" frequency behaviour by choosing the constructive materials and the structural configuration. The experience of GEM allows designing this type of structures for signal filtering or minimization of radar-cross section in ships or planes.
Shielding for electronic systems	GEM studies solutions for assuring the proper operation of specific equipment in the place where it has been designed for. The use of new materials as conductive polymers substituting or complementing metals, the proper location of electronic devices inside the shielding box and the size, shape and location of the slots and holes on that box are some of the elements where GEM focuses the research and consulting services offered to companies.
Nanomaterials design for microwave applications	As a new researching line in our group we are working on nanomaterials design in order to include them in several microwave applications coping with demands of medical implementations, image diagnosis, electromagnetic shielding and filtering.
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Together towards an horizon of development





"We all live under the same sky, but nobody has the same horizon "

Konrad Adenauer

OUR PARTNERS

We count with an important number of partners whom we have established solid relationships with, along with contracts, patents and researching projects. In GEM we are still consolidating the business and universities ties for growing as a working and researching group with the aim of offering the very best of us as researchers directly in contact with the nowadays industrial applications.













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We are at your service





"We do not have the opportunity to make so many things, so each thing we do must be excellent. Because this is our life".

Steve Jobs

OUR CUSTOMERS

Quality in each of our works is our main goal and our customers know it since they trust in our vast experience as engineers and researchers for entrusting us with their most demanding projects. In GEM we are always pleased to help you with your needs, so that your dreams can be fullfilled and your highest expectations are realized.







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On top of the R&D





"When somebody is climbing a mountain nobody leaves the mate for reaching the peak by himself."

Tenzing

Regarding the projects developed over the last 8 years, we have been covering a wide spectrum within microwave whose patent was made by GEM . The main feature of this filter is its ability of adapting its configuration to any situation given by the material that we

Figure 1

shown in Figure 1. This equipment has been designed for food industry with very small and specific dimensions, which has never been designed before for these kind of gadgets. overall efficiency, since it carries out the process in only 1.20 seconds. Nowadays this microwave equipment is working at the technological centre for the marble in Cehegín (Murcia).





engineering, food industry, filtering, shielding, dielectric measuring and calibration procedures. Next, we present several examples of our works to show you part of our group inside.

In the Figure 1, we can observe a new kind of intelligent filter oriented to microwave heating applications

want to process by means of microwave. This sort of configuration solves the main problem of corrugated filters offered in the industry till the moment. The main disadvantage of this filtering devices it is its inability of proceesing ceratin materials with like marble and granite. A new design for a microwave oven carried out is

Figure 3



What industrial applications is concerned a microwave oven is shown in Figure 3. The patent of this oven was developed in our group and its main functionality is the polymerization of resin over marble. This oven works at 10 kW and improves the If you wish to get in contact with us then please do no hesitate to do it,

GEM Group

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