ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

CRT/DET - Next-generation computational electromagnetics

Funded By	FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014] Dipartimento DET
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Context of the research activity	The PhD topic will be the development of novel methodologies in the next-generation computational electromagnetics focused on integral equations and method of moments.
Objectives	In the last years, the electromagnetic (EM) problems have scaled up in complexity and size: the EM simulations are attempted of the entire system, and the use of simulation tools has been explored as a way to reduce the cost of certifying complex platforms. This PhD research activity will address the efficient and accurate analysis of real-life multi-scale antenna problems via the moment method (MoM) solutions of surface integral equations (SIEs). SIEs have emerged as the dominant technology for the EM modeling of antenna placement on large and complex platforms such as aircrafts, ships, satellite, and vehicles. In the analysis of multi-scale structures that are electrically large, but with geometrical details much smaller than the working wavelength, the solution has multiple scales of variation; this generates ill-conditioning in the associated linear system that heavily impacts on accuracy and solution cost. The key idea is to keep different scales of variation directly in the basis functions that discretize the problem. Moreover, efficiently and accurately evaluating the singular or near-singular double surface integrals is fundamental to moment method solutions of surface integral equations. Hence, two key issues, crucial in the analysis of multi-scale structures, will be investigated: devising discretization schemes insensitive of wide scale ranges, and effective and accurate integration schemes for computing the SIE-MoM system matrix.
Skills and competencies for the development of	- Expertise in electromagnetic (EM) modelling and simulation - Capabilities in programming with e.g. C/C++, Matlab, Python, Fortran

the activity	