PhD in Electrical, Electronic and Communication Engineering

Research Title: CAD-based enhanced modeling of cable bundles

Supervisor	Igor Simone Stievano (igor.stievano@polito.it) Flavio Canavero (flavio.canavero@polito.it)
Contact	https://emc.polito.it/

Context of the research activity	Complex cable networks are used in several real engineering applications for data communication. A well-known example is provided by the vehicular (e.g., automotive or aerospace) data link structures. In this scenario, numerical simulations in the early design stage help reduce time- and cost-expensive redesign by flagging potential problems prior to actual fabrication such as by predicting the integrity of the electrical signals flowing through the wires or the crosstalk interference among different cables. Cable bundles are usually described in terms of the cascade connection of uniform transmission line structures with a random placement of wires. The above modeling idea is a simple abstraction that unavoidably leads to possible wrong predictions due to the unrealistic and unphysical description of the wire location at the interface between adjacent pieces. A different modeling approach is desirable and becomes an important challenging problem that will be addressed in the proposed activity.
Objectives	Standard 3D tools well-known in the mechanical or engineering drawing domains are used to create a physics-consistent representation of the bundle. The cable is then modeled in terms of either a circuit approach or via a nonuniform transmission line structure. For the former case, a classical circuit approach is used. In the latter case, the governing electromagnetic equations, that turn out to be defined by a system of non uniform first order partial differential equations, are solved via approximate techniques (e.g., via discretization and/or decomposition in terms of know analytical solution for specific geometric profiles). An important phase in the proposed research is dedicated to model validation, where model responses are compared with measurements carried out on real bundles.
Skills and competencies for the development of the activity	Circuit theory and basic electromagnetics