Joe Wiart (Orange Labs, France)

Stochastic Dosimetry to Handle the Variability in Numerical Human Exposure to RF EMF

Despite the intensive use of wireless communication systems there is today an important public concern about the exposure to electromagnetic field (EMF). The assessment of the radio frequency(RF) EMF is therefore more and more important and large effort have been conducted since 20 years to develop the RF dosimetry (i.e. numerical and experimental methods to quantify the RF exposure) and check the compliance to limits. Taking advantage of the progress in high performance calculation (HPC) the numerical dosimetry is more and more use to assess the exposure. Numerical method such as the finite difference in time domain (FDTD) method is daily use to calculate the Specific Absorption Rate (SAR) and design radio communication systems. With the increasing and versatile use of wireless communication systems the usual dosimetry is facing the challenge of the variability. In spite of large progress in HPC the FDTD calculations still request large computation time that are not compatible with usual Monte Carlo method often used to handle the variability. The stochastic dosimetry is a novel approach combing numerical electromagnetic solver and statistics to manage the influence of variations of the inputs on the outputs of heavy dosimetric numerical calculations using a combination of deterministic and statistical methods. In this talk we will present, with example, the state of the art in the deterministic dosimetry and we will introduce the new method based on surrogate modeling. We will explain how such surrogate model can be built with a truncated sparse Generalized Polynomial Chaos Expansion and regression to estimate the coefficient of the polynomials. Example such as brain exposure induced by a mobile phone having variable location will be given in the talk to illustrate the efficiency of such innovative method to handle the variability in numerical human RF exposure.