Uncertainty quantification for electromagnetic propagation in enclosed environments

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In most cases, a generic subsystem embedded inside a vehicle or more generally an electronic system may be threatened by intentional transmitters close to it. Cabling and apertures offers major routes by which electromagnetic interference (EMI) will enter a subsystem. Since electronic systems (aeronautical ones for instance) are often subjected to thermal and mechanical random variations, their geometrical structures may become uncertain. Previous works laid emphasis on the importance of propagating these uncertainties via transmission-line method, TLM, (M. Panitz and C. Christopoulos, in Proc. ICEAA, 2012, pp. 182-185). Few studies were achieved to experimentally check the impact of random variables (r.v.'s) modeling in EMC framework (D. Thomas et al., in Proc. ESA workshop on EMC, 2012). Figure 1 gives an inner view of the cabinet designed and achieved by EMC group (Institut Pascal) to automate Monte Carlo (MC) the electromagnetic propagation of waves inside the enclosure assuming random geometrical variations due to moving external trap (T), inner moving plate (P) and rotating stirrer (S). Figure 2 shows a set of MC measurements of parameter S21 between emitting MSRC log-periodic antenna and dipole (Fig. 1).

This work aims to provide experimental validation of different advanced statistical techniques in comparison with MC statistics. Among the various stochastic approaches available in the literature, the final presentation will give details about the retained methods including: unscented transform, UT, (L. de Menezes et al., IET Sci. Meas. Technol., 2008, **2**, pp. 88-95); stochastic collocation, SC, (P. Bonnet et al., Comptes Rendus Physiques, **10**, 2009, pp. 54-64); polynomial chaos expansion, PCE, (O. Aiouaz, Ann. Telecom., **66**, 2011, pp. 409-418).

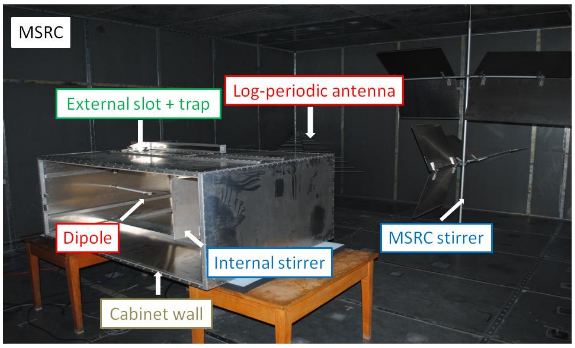

Fig. 1. Embedded cabinet inside MSRC (Institut Pascal)

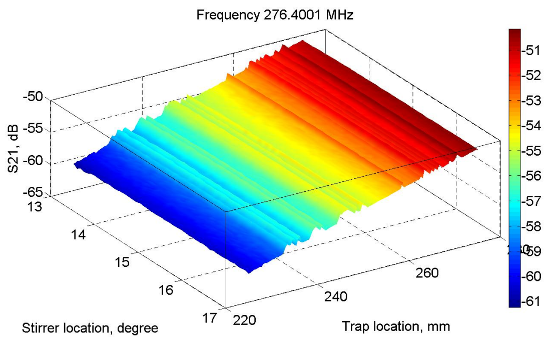

Fig. 2. Distribution of MC measurements including 2 r.v.'s: trap and stirrer (Fig. 1)