Electromagnetic Time Reversal robustness for EMC applications

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The proposed work deals with the robustness of electromagnetic time reversal (ETR) process. Many studies were achieved covering a huge diversity of domains: communication (A. Tourin et al., Nato Sciences Series, **II**, 2003), imaging (D. Liu et al., IEEE Trans. on Ant. and Prop., 2005), focusing (M. Davy et al., Comptes Rendus Physiques, **11**, 2010, pp. 37-43). In this framework, electromagnetic compatibility (EMC) may take large benefits from ETR (H. Moussa, PhD thesis, Univ. Paris 11, 2011) since it allows a potential control of electromagnetic (EM) waves. This could potentially decrease time and costs during EMC standard tests assuming external conditions (antennas location, environment, devices under test properties) are perfectly known (ideal case rarely encountered). Few studies (G. Papanicolaou, SIAM, 2004, pp. 1133-1155) were achieved to assess the potential impact of randomness on ETR. The purpose of this paper is to put the focus on the robustness and the diversity of using TR for EMC: shielding effectiveness, EM field controlling, wire diagnosis for instance.

As explained previously, the final presentation will give details about the interests of ETR in many EMC applications. This abstract will lay emphasis on an ETR experiment led in reverberation chamber (RC) from Institut Pascal, Clermont-Ferrand, France (Fig. 1). It is modeled with time domain solver (CST©), the source frequency range is from 1 to 3 GHz and the equipment under test (EUT) is represented by a cabinet embedded with opened panel, moving plates (P1 and P2, Fig. 1) and wire systems (S1, S2, S3, Fig. 1) with different susceptibility levels. During ETR process, geometrical random variations are applied to the external environment and their effects are statistically quantified on TR focusing (on wire 1, Fig. 2). Time reversal robustness will also be evaluated regarding losses limitations; especially for transmission line network fault detection application (L. El Sahmarany, PIER, **31**, 2013, pp. 45-58).

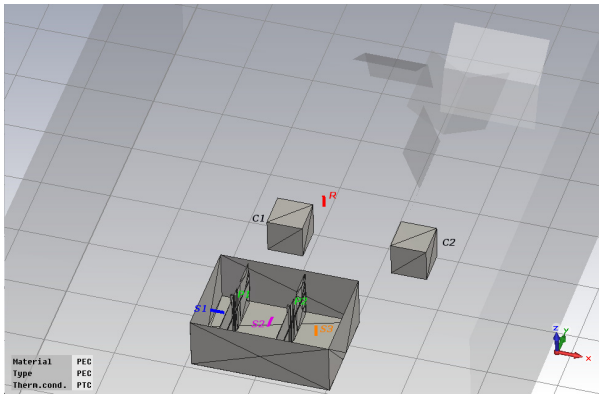

Fig. 1. Numerical setup for ETR for selective focusing in a cabinet (3 wires S1, S2 and S3)

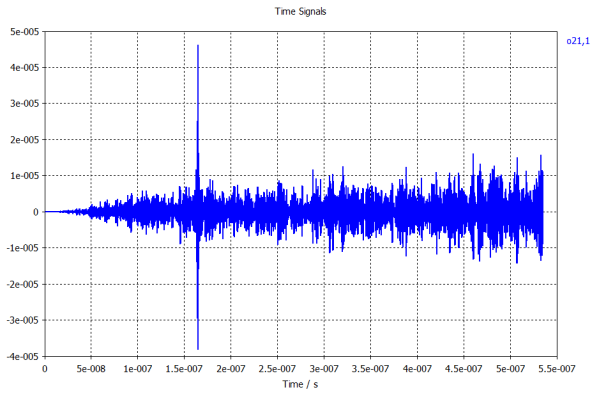

Fig. 2. Focusing after ETR on wire S1 (Fig. 1)