# Advancing-front algorithm for enhanced-efficiency broadband compressive domain decomposition

M. Righero*[1], F. Vipiana [1, 2], and G. Vecchi[2]
(1) Istituto Superiore Mario Boella, via Pier Carlo Boggio 61, I-10138, TO, Italy
(2) Politecnico di Torino, corso Duca degli Abruzzi 24, I-10129, TO, Italy

Compressive domain decomposition allows full-wave analysis of electrically large structures at a reduced memory and CPU cost [e.g.: L. Matekovits, G.Vecchi, G. Dassano, M. Orefice, *Proc. Dig. IEEE Antennas and Propagation Soc. Int. Symp*. 2001; S. Prakash, R. Mittra, *Microw. Opt. Technol. Lett.*, 2003]. The basic idea is to split the structure in subdomains, solve a number of suitable EM problems on each subdomain in isolation, and use the computed solutions - "glued" in an appropriate way- to build the space where to seek the solution to the original problem. This space of "aggregate" functions is much smaller than the original solution space, generally the one spanned by RWG functions, so the whole process amounts to a size reduction of the problem. This typically renders a direct solution feasible and convenient, and avoids any convergence speed issue. Moreover, the process is amenable to be run in a parallel and distributed way.

A challenge for these methods is the efficient application to structures that require a tear-and-interconnect approach to domain-decomposition (as opposed to naturally segmented structures, like arrays). This poses problems in: a) avoiding spurious edge effects in standalone domain solutions, and b) efficiently ensuring continuity of the solution across tear boundaries.

Here we propose an "advancing front" approach; instead of sharply cutting (and re-connecting) the subdomains, the border of every subdomain is partially overlapped to the adjacent subdomains. Additional sources are placed on the boundaries of the extended (overlapping) subdomains to properly construct the solution space for the whole (original) structure. The practical result is a smoothing of the aggregate functions generated, which carries over onto the quality of the final solution for a given number of employed aggregate functions. The advancing front algorithm is based on the adjacency matrix of mesh and run linearly in the number of elements of the mesh and the width of the extended border. The approach is very stable and allows broadband analysis without re-meshing, i.e. using the (fine) mesh for highest frequency, and the associated domain decomposition, at all frequencies.

Examples of results showing the performances will be presented, with verification of compressed solution against solutions without domain decomposition.