URSI-B EMTS 2025, Bologna, 23–27 June

A Model order reduction method for smoothly varying propagation problems

G. G. Gentili, M. Oldoni
Politecnico di Milano, DEIB, Via Ponzio 34/5, I-20133 Milano (Italy)
gianguido.gentili@polimi.it

Model order reduction methods are quite popular because they offer significant advantages in terms of computation time. Different solutions to build the reduced model exist in the literature, from very general ones [1] to others that are mode tailored to the problem. Our approach aims to solve by a model reduction the problem of propagation along smoothly varying waveguides. The method, named HiMod (Hierarchical Model order reduction) has been successfully applied to model propagation in smoothly varying structures in several physical problems and the authors applied it for the first time to electromagnetic wave propagation in smoothly varying rectangular and circular waveguides [2], [3]. In this work we extend the method to arbitrary dielectric waveguides. The extension is not trivial because of the specific feature of the modes in dielectric waveguides, but the method showed excellent performances in modelling roughness in buried waveguides and in curved dielectric waveguides.

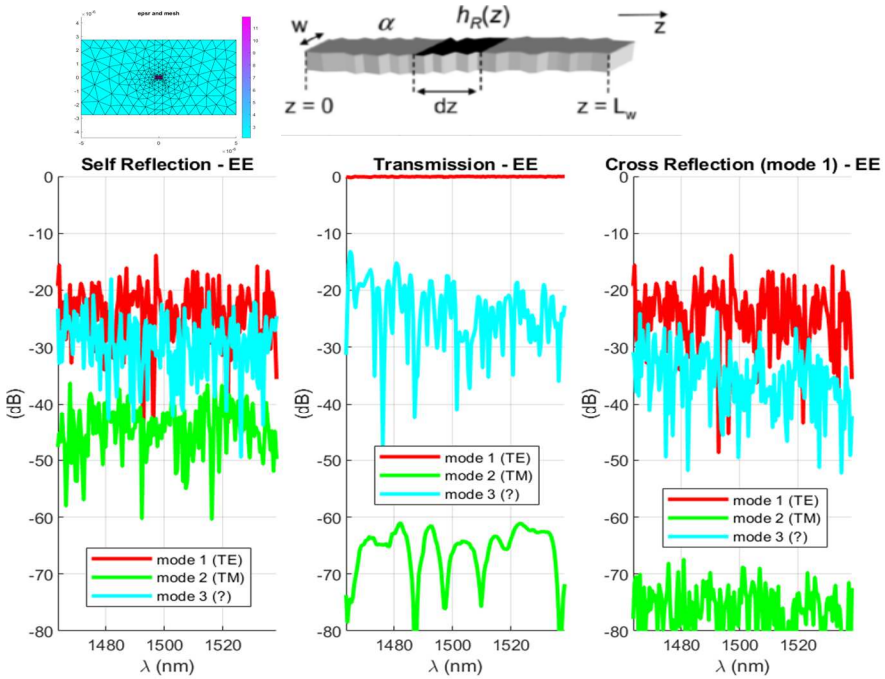

Figure 1. Scattering by rougness ina buried waveguide.

References

[1] V. de la Rubia and M. Mrozowski, "A Compact Basis for Reliable Fast Frequency Sweep via the Reduced-Basis Method," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 66, no. 10, pp. 4367-4382, Oct. 2018.

[2] G. Garcia-Contreras *et al*., "Advanced Modeling of Rectangular Waveguide Devices With Smooth Profiles by Hierarchical Model Reduction," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 71, no. 11, pp. 4692-4702, Nov. 2023.

[3] G. Giannetti, S. Selleri, G. G. Gentili, G. Garcia-Contreras, J. Córcoles and J. A. Ruiz-Cruz, "Advanced Modeling of Circular Waveguide-Based Devices With Smooth Profiles Using Transformation Optics and Hierarchical Model Reduction," in *IEEE Journal of Microwaves*, vol. 4, no. 4, pp. 675-689, Oct. 2024.