NUMERICAL WAVE PROPAGATION IN SPATIAL AND TEMPORAL METAMATERIALS

BARBARA VERFÜRTH*

ABSTRACT

Many applications use artificially constructed materials, often coined as metamaterials, to obtain enhanced properties. Such materials commonly feature fine spatial (composite) structures, which require numerical multiscale methods for efficient simulation. In the last years, there has been an increasing interest in time-modulated materials, which means that the multiscale material coefficients are additionally time-dependent. In this talk, we study the wave equation with spatially multiscale, (slowly) time-dependent coefficients as model problem. We propose and rigorously analyze a numerical multiscale method in the spirit of the Localized Orthogonal Decomposition [1]. We highlight new theoretical aspects due to the time-dependent coefficient (and multiscale spaces). Further, we numerically investigate an adaptive approach for the (re-)computation of the time-dependent multiscale basis functions. Finally, we give a brief outlook on the case when the coefficients are no longer slowly evolving in time, but show a multiscale nature also in time.

The talk is based on joint work with Bernhard Maier.

References

[1] Bernhard Maier, Barbara Verfürth. *Numerical upscaling for wave equations with time-dependent multiscale coefficients*, arXiv preprint 2107.14069 (2021)

* Institut für Angewandte und Numerische Mathematik, Karlsruhe Institut für Technologie, barbara.verfuerth@kit.edu