Many engineering applications require the numerical evaluation of time-harmonic wave propagation problems over a range of frequencies. The most used technique to discretize partial differential equations is the finite element method. Due to the oscillations of analytical solutions the finite element discretization often becomes computationally expensive.

Model order reduction methods provide reliable approximations of the solution at low computational cost. In particular, they allow very fast responses both for real-time and multi-query contexts.

This talk deals with novel model order reduction techniques tailored to time-harmonic wave problems relying only on a precomputed set of snapshots, they present great flexibility, since they allow the construction of a surrogate starting from snapshots obtained via black-box solvers (e.g., commercial software).

The method’s efficiency is investigated in several examples, including transmission-reflection and scattering problems. Especially in the context of optimal control problems, where standard numerical techniques are unfeasible, the employment of surrogate models is crucial.