

Title: Schwarz algorithms for time-harmonic wave problems

Abstract: It is an undeniable fact that in the modern era of the 21st century there is a tremendous development of technology due to the advancements in the numerical analysis of partial differential equations. Various phenomena can be modeled by partial differential equations. In most cases, obtaining a closed form of the solution is difficult or impossible and the numerical analysis comes into play. Despite the great advancements, there are classes of problems that are notoriously difficult to solve such as time-harmonic wave propagation problems. Maxwell formulated the problem by giving a set of strongly coupled partial differential equations and Oliver Heaviside, later on, wrote the equations in the modern form that is known today. Although the equations describing the behavior of electromagnetic waves are known for a substantial amount of time, there are still obstacles to solving efficiently these equations. A class of methods that seems to work for solving time-harmonic wave problems is domain decomposition methods. Hermann Schwarz back in 1869 devised an algorithm to solve the Laplace problem in a union of a disk and a rectangle solving alternatively on each subdomain. The idea is to split the domain into subdomains and solve the local subproblems. In this presentation, results of the implementation of Schwarz algorithms for time-harmonic problems will be presented from a numerical point of view and a mathematical point of view.