

**Title: Schwarz Legendre collocation methods for a Rayleigh-Bénard problem**

**Abstract:** Spectral collocation methods are optimal numerical methods in the sense of using small meshes obtaining results with great precision. One of the problems with these methods is ill conditioning of the resulting algebraic systems when the mesh size is increased. They present a maximum mesh size that can be considered. This size is not enough to solve the problem when the solutions have many oscillations or different scales. A strategy to increase the size of the mesh is the use of domain decomposition. Schwarz alternating is the domain decomposition technique most used for fluid dynamics problems. In this work we consider an alternating Schwarz domain decomposition method to solve each time step of a time evolution scheme or Newton method used to solve a Rayleigh-Bénard problem. The convergence of the alternating Schwarz domain decomposition method for the evolution and stationary problems in an infinite domain with overlap has been theoretically proved. An efficient algorithm with any number of subdomains has been performed. A benchmark with solutions obtained with different methods guarantees the reliability of the method. The computational cost is similar to other methods, it is parallelizable, and turbulence can be addressed.

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