Small-time global exact controllability to the trajectories of the Boussinesq system

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In this talk, we consider the global exact controllability problem to the trajectories of the Boussinesq system. We show that it is possible to drive the solution to the prescribed trajectory in small time by acting on the system through the velocity and the temperature on an arbitrary small part of the boundary. The proof relies on three main arguments. First, we transform the problem into a distributed controllability problem by using a domain extension procedure. Then, we prove a global approximate controllability result by following a strategy of Coron and collaborators, which deals with the Navier-Stokes equations. This part relies on the controllability of the inviscid Boussinesq system and asymptotic boundary layer expansions. Finally, we conclude with a local controllability result that we establish with the help of a linearization argument and appropriate Carleman estimates.