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# Shape optimization and related problems

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**Abstract:** In this talk, we emphasize the connection between shape optimization and overdetermination. Overdeterminated problems usually arise from the shape optimization context by imposing the optimality condition computed via domain derivative. We present a Serrin-type result for an elliptic system of equations, overdetermined with both Dirichlet and generalized Neumann conditions, proved via moving planes method. With this tool, we characterize the critical shapes of some domain functionals under volume constraints. Furthermore, we show that, in the context of Robin boundary conditions, the symmetry property á la Gidas, Ni and Nirenberg does not hold in dimension greater than 2, even for superharmonic functions and we provide an explicit example.