1145-VC-606 **Krishnamurthy Dvijotham**, **Bala Krishnamoorthy** and **Ben Rapone***,
benjamin.rapone@wsu.edu. *Robust Feasibility of Systems of Quadratic Equations Using Topological Degree Theory.*

We consider the problem of measuring the *margin of robust feasibility* of solutions to a system of nonlinear equations. This problem turns out to be NP-hard in general. We study the special case of a system of quadratic equations, which shows up in many practical applications such as the power grid and other infrastructure networks. We develop approaches based on topological degree theory to estimate bounds on the robustness margin of such systems. Our methods use tools from convex analysis and optimization theory to cast the problems of checking the conditions for robust feasibility as a nonlinear optimization problem. We then develop *inner bound* and *outer bound* formulations for this optimization problem, which could be solved efficiently to derive lower and upper bounds, respectively, for the margin of robust feasibility. We evaluate our approach numerically on standard instances taken from the MATPOWER database of AC power flow equations that describe the steady state of the power grid. The results demonstrate that our approach can produce tight lower and upper bounds on the radius of robust feasibility for such instances. (Received September 11, 2018)