Sequential Quadratic Programming without a Penalty Function or a Filter for Nonlinear Equality Constrained Optimization

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Abstract: We present a sequential quadratic programming method without using a penalty function or a filter for solving nonlinear equality constrained optimization. In each iteration, the linearized constraints of quadratic programming are relaxed to satisfy two mild conditions, the step-size is selected such that either the value of objective function or the measure of constraint violations is reduced sufficiently. As a result, our method has two nice properties. Firstly, we do not need to assume the boundedness of the iterative sequence; Secondly, we do not need any restoration phase which is necessary for filter methods. We prove that either every limit point of the sequence generated by the method is a feasible point with at least one of which being a Karush-Kuhn-Tucker point, or there is a limit point which is either a Fritz-John point or an infeasible stationary point. By controlling the exactness of linearized constraints and introducing a second-order correction technique, without requiring linear independence constraint qualification, the algorithm is shown to be locally superlinearly convergent. The numerical results show that the algorithm is more effective than that using a penalty function.

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Key words: sequential quadratic programming, penalty function, filter, regularity, global and local convergence analysis.

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