Adaptive Iterative Linearization Galerkin Methods for Nonlinear PDE

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A wide variety of (fixed-point) iterative methods for the solution of nonlinear equations (in Hilbert spaces) exists. In many cases, such schemes can be interpreted as iterative local linearization methods, which can be obtained by applying a suitable linear preconditioning operator to the original (nonlinear) equation. Based on this observation, we will derive a unified abstract framework which recovers some prominent iterative schemes. Furthermore, in the context of numerical solutions methods for nonlinear partial differential equations, we propose a combination of the iterative linearization approach and the classical Galerkin discretization method, thereby giving rise to the so-called *iterative linearization Galerkin (ILG)* methodology. Moreover, still on an abstract level, based on elliptic reconstruction techniques, we derive a posteriori error estimates which separately take into account the discretization and linearization errors. Subsequently, we propose an adaptive algorithm, which provides an efficient interplay between these two effects.

References

[1] Pascal Heid and Thomas P. Wihler, *Adaptive Iterative Linearization Galerkin Methods for Nonlinear Problems*, arXiv.org, Report Nr. 1808.04990, 2018.