# Bern-Fribourg Graduate Seminar

## a seminar for Master and PhD students

Thursday 3rd October, 2024: 17:15 - 18:00

Room 2.52, Perolles 08, Fribourg

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# Contractive iterative linearization Galerkin methods

**Abstract**

Fixed-point iteration methods are crucial tools for the solutions of nonlinear equations. In many cases, such schemes can be considered as iterative linearization methods, which can be obtained by applying a suitable preconditioning operator to the original equation. In this work, we propose a contractive iterative linearization Galerkin (ILG) method for nonlinear equations based on the Boyd-Wong–Picard iterative linearizations. This non-standard perspective will allow us to conduct a general abstract a priori convergence analysis in combination with the classical Galerkin discretization method. Moreover, we derive a posteriori residual and error estimates that separately account for the discretization and linearization errors. Furthermore, the contractive ILG approach will be applied to the specific context of finite element discretizations of semilinear diffusion reaction equations, and some numerical experiments will be performed to validate the a priori and a posteriori estimates. Furthermore, exploiting the compactness arguments, we extend our general convergence analysis to the case of weakly contractive fixed-point iterations.