

Steepest Descent Method for Minimum Residual Methods for Nonlinear Problems

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Abstract

2025 marks the 17th anniversary of our first foundational paper on the Discontinuous Petrov-Galerkin method, in short the DPG method. In the talk, I will attempt to present DPG fundamentals for linear problems [1] illustrated with a few numerical examples, and an outlook at the generalization of the DPG methodology to nonlinear problems represented by nonlinear elasticity [2]. In particular, I will attempt to compare Newton-Raphson and Steepest Descent methods.

[1] L. Demkowicz and J. Gopalakrishnan, The Discontinuous Petrov-Galerkin Method, *Acta Numerica*, 2025.

[2] J. Zhang and L. Demkowicz, Nonlinear Elasticity with the Discontinuous Petrov-Galerkin Method. I. Various Variational Formulations, Oden Institute Report 2024/5.