An Adjoint Based Multi-Goal Oriented Error Estimation for Non-linear Problems

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In this talk, we formulate goal-oriented mesh adaptivity for multiple functionals of interest for nonlinear problems in which both the Partial Differential Equation (PDE) and the goal functionals may be nonlinear [1]. The presented method is based on a posteriori error estimates in which the adjoint problem is used [3] and a partition-of-unity is employed for the error localization that allows us to formulate the error estimator in the weak form [2]. Finally our techniques are substantiated with a numerical example, where mesh adaptivity is driven by more than one goal functionals.

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References:

[1] B. Endtmayer, U. Langer and T. Wick, *Multigoal-Oriented Error Estimates for Non-linear Problems*, RICAM Report No. 2018-08, 2008.

[2] T. Richter and T. Wick, *Variational localizations of the dual weighted residual estimator*, J. Comput. Appl. Math. 279 , pp. 192–208, 2015.

[3] R. Becker and R. Rannacher, *An optimal control approach to a posteriori error estimation in finite element methods*. Acta Numer., 10: pp. 1–102, 2001.

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