Albert-Ludwigs-Universität Freiburg
Abteilung für Angewandte Mathematik
Prof. Dr. Patrick Dondl
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Wintersemester 2022/23

Theorie und Numerik partieller Differentialgleichungen
Projekt 4: Obstacle problem implementation with penalty

Abgabe: per E-Mail an den Tutor bis, 25.01.23, 14Uhr

Teil 1. Write a program that implements the penalty method in the book of S. Bartels (Numerical Methods for Nonlinear Partial Differential Equations) to approximate the solution to the obstacle problems. This consist of minimizing the following energy functional $I_\epsilon(u)$ in the set of functions $u \in\in H_0^1(\Omega)$

$$I_\epsilon(u) = \frac{1}{2}\int_\Omega |\nabla u|^2 \, dx - \int_\Omega fu \, dx + \frac{\epsilon^{-2}}{2}\int_\Omega (u-\chi)_-^2 \, dx$$

where $\epsilon > 0$ is a small penalty parameter and $(s)_- = \min\{s, 0\}, s \in \mathbb{R}$.

Teil 2. Compare this (for a selection of mesh sizes and values of ϵ) with the Semi-smooth Newton Iteration and the global primal-dual method.