

Nonlinear functional analysis: list of topics

1. Unbounded linear operators, energy space.
2. Nonlinear operators, Gateaux derivative and its properties.
3. Convex functionals and monotone operators.
4. Duality mappings.
5. Potential operators, variational principle, existence of minimizers.
6. Well-posedness of nonlinear equations with potential operators.
7. Well-posedness of nonlinear equations with non-potential operators.
8. Well-posedness of nonlinear elliptic PDEs with potential operators in $H_0^1(\Omega)$.
9. Well-posedness of the p -Laplace equation.
10. Well-posedness of nonlinear elliptic PDEs with non-potential operators.
11. Minimization on convex sets, projections.
12. Variational inequalities, solvability, the obstacle problem.
13. The Galerkin method for linear and nonlinear operator equations.
14. Gradient method: general ideas, linear operator equations.
15. Gradient method and simple iteration for nonlinear operator equations.
16. Newton type methods for nonlinear operator equations.