High precision identification of an object: optimality conditions based concept of imaging

Victor A. Kovtunenko[a,b] and Karl Kunisch[a]

[a] *Institute for Mathematics and Scientific Computing, KF-University of Graz, NAWI Graz, Heinrichstr.36, 8010 Graz, Austria*

[b] *Lavrentyev Institute of Hydrodynamics, 630090 Novosibirsk, Russia*

Email: {victor.kovtunenko, karl.kunisch}@uni-graz.at

The problem of identification of a geometric object and reconstruction of its geometric and physical parameters from given measurements is an inverse problem, which belongs to the field of shape and topology optimization. We suggest a novel direct approach based on necessary optimality conditions for finding extrema of an objective function with respect to trial geometric variables. Henceforth, the test object can be imaged precisely from zero sets of the imaging function deduced from input data and measured output data. As result we obtain a robust and highly accurate numerical method for object identification. We specify in detail its particular realization for the model Helmholtz problem. For numerical solver we suggest an original Petrov-Galerkin based enrichment method within generalized FEM.

The research is supported by the Austrian Science Fund (FWF) in the framework of the SFB F32 MOBIS and the project P26147-N26.

References

[1] V.A. Kovtunenko and K. Kunisch, High precision identification of an object: optimality conditions based concept of imaging, *SIAM J.Control Optim.* **52** (2014), 1, 773–796.

[2] V.A. Kovtunenko, State-constrained optimization for identification of small inclusions, *Proc. Appl. Math. Mech* **11** (2011), 1, 721–722.