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Investigation of one inverse problem in case of modeling water areas with “liquid” boundaries

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In hydrodynamics often appears the problem of modeling water areas (oceans, seas, rivers, etc.) with “liquid” boundaries. “Liquid” boundary means set of those parts of boundary where impermeability condition is broken (for example, straits, bays borders, estuaries, interfaces of oceans). Frequently such effects are ignored: for “liquid” boundaries the same conditions are used as for “solid” ones, “material boundary” approximation is applied [1]. Sometimes it is possible to interpolate the results received from models of bigger areas. Moreover, approximate estimates for boundary conditions are often used. However, those approximations are not always valid. Sometimes errors in boundary condition determination could lead to a significant decrease in the accuracy of the simulation results.

In this work one way of considering the problem mentioned above is described. According to this way one inverse problem on reconstruction of boundary function in convection-reaction-diffusion equations which describe transfer of heat and salinity is solved. The work is based on theory of adjoint equations [2] and optimal control, as well as on common methodology of investigation inverse problems [3]. The work contains theoretical investigation and the results of computer simulation applied for the Baltic Sea. Moreover, conditions and restrictions that should be satisfied for solvability of the problem are entered and justified in the work.

Submitted work could be applied for the solution of more complicated inverse problems and data assimilation problems in the areas with “liquid” boundaries; also it is a step for developing algorithms on computing level, speed, temperature and salinity that could be applied for real objects.

References

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