A Localized Direct Meshless Method for Ill-posed Inverse Problems

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In this talk we present a localized direct meshless computational method using approximate particular solutions for solving some ill-posed inverse problems of Poisson equation. The Method of Approximate Particular Solutions (MAPS) has recently been developed and demonstrated to be effective in solving various types of partial differential equations (PDEs). The globally implemented MAPS, however, involves the solution of a dense matrix, which is highly ill-conditioned, and hence impractical for handling real large-scale science and engineering problems. We develop a localized scheme for MAPS, which gives a well-conditioned and sparse matrix, and demonstrate its potential to solve real large-scale problems. Furthermore, we successfully combine the localized MAPS with the Method of Fundamental Solutions (MFS) to solve some Cauchy problems, which are typical ill-posed inverse problems. Numerical examples in two-dimensional space are given to illustrate the effectiveness and stability of the proposed method.