Determination of Heat Transfer Coefficients

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The determination of thermal boundary coefficients constitutes an important inverse problem in design and optimization processes in heat transfer and polymer industries. In particular, the surface heat transfer coefficient may depend on space, time or temperature and it appears as a linkage function in a linear convective or nonlinear radiative Robin boundary condition of the third kind. At the steady state the problem is more known as a corrosion coefficient identification and it can be reduced to solving a Cauchy problem for an elliptic equation. In the unsteady-state case, the extra time dimension offers a wider variety of inverse problem formulations. The additional information sufficient to guarantee a unique solution may come in the form of a point or a boundary integral measurement. Both classical and weak solutions will be sought. Although the unique solvability of solution may hold under certain restrictions on the data, the inverse problem is still ill-posed since small errors in the measured data cause large errors in the output desired solution. Consequently, some sort of regularization is needed in order to render a stable solution. Since the governing heat equation that we consider is linear and with constant coefficients a fundamental solution is available explicitly. Moreover, all the knowns (input) and unknowns (output) in the inverse problem that we consider are at the boundary and the discretization of the boundary only is the essence of the boundary element method (BEM). All these make the BEM well-suited and appropriate to numerically discretize the inverse problem under investigation. The results of the numerical investigations will also be reported and discussed at the conference.

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