USE OF INTEGRAL EQUATION APPARATUS IN INFRARED TOMOGRAPHY[1]

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In the report, the known technique of IR tomography of a hot gas [1] on the example of the flame of the widely used laboratory burner is newly stated. The variant is described for using two regimes of flame diagnosis: the active one (ON) – with included translucence source and passive one (OFF) – without such source. The active-passive diagnosis makes possible to obtain two experimental functions and two new two-dimensional integral equations concerning the absorption coefficient k and the Planck function B (it describes the emission and gives the possibility to calculate the temperature profile T of a medium).

In the case of axial symmetry and parallel scanning the flame, the two-dimensional equations are transformed into one-dimensional singular integral equations (SIE) of Abel's type concerning k and B. For its numerical solving, one uses the generalized quadrature method [2] (in a new version) and the Tikhonov regularization method with experimental data smoothing by splines and without smoothing.

The software package for MatLab 7 is developed. With its help, results of experimental diagnosis of the burner flame for some wave numbers ν and in some flame cross-sections were processed. This processing confirms that a SIE has the self-regularization and its solution problem is moderately ill-posed. Use of the generalized quadrature method with preliminary spline-smoothing the experimental data, but without the Tikhonov's regularization gives the possibility to obtain practically the same results as with use of the Tikhonov regularization method.

Specific feature of the proposed technique is that it does not require a special determination of the absorption coefficient k by a direct measuring or through a database, for example, the HITRAN/HITEMP [3].

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[1]This work is supported by the RFBR (grant № 13-08-00442) and DTU Denmark (project № 010246)