Direct simulation of an integral equation of the first kind

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Abstract.

Usual approaches to inverse problems are regularization, the least square method(optimization) and AI. In their numerical simulation unpreferable situation often occurs due to rounding error before obtaining preferable numerical results.

We developed IPNS (Infinite Precision Numerical Simulation). The method consists of spectral collocation methods and multiple precision arithmetic. It enables numerical simulation in ultimate precision. In the paper it is directly applied to the following integral equation of the first kind:

$$\int_{-1}^{1} e^{xy}u(y)\,dy = f(x); \quad f(x) = \frac{(2x - 1)e^x + e^{-x}}{2x^2}; \quad f(0) = 1.$$

Numerical results are satisfactory.