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Numerical methods for CSIE in $[-1, 1]$

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We consider the following class of integral equations

$$(D^{\alpha,\beta} + K)f = g,$$

where $-(\alpha+\beta) = \{-1, 0, 1\}$, g is a known function on $(-1, 1)$, the operator $D^{\alpha,\beta}$ is defined as follows

$$(D^{\alpha,\beta} f)(y) = af(y)v^{\alpha,\beta}(y) + \frac{b}{\pi}\int_{-1}^{1}\frac{f(x)}{x-y}v^{\alpha,\beta}(x)dx,$$

K is a compact operator of the following type

$$(Kf)(y) = \int_{-1}^{1} k(x, y)f(x)v^{\alpha,\beta}(x)dx,$$

and $v^{\alpha,\beta}(x) = (1 - x)^{\alpha}(1 + x)^{\beta}$ is a Jacobi weight.

It is well-known that, using the properties of $D^{\alpha,\beta}$, such class of equations can be lead back to Fredholm-type integral equations. However, if the invariant spaces of $D^{\alpha,\beta}$ are not known, then the smoothness of Kf is not known too. Such invariant spaces have been recently determined by the authors, extending the results in [1].

In this talk the authors consider the resulting Fredholm integral equations in weighted continuous spaces and propose simple numerical methods for the approximation of their solutions in such spaces with special attention to the case $-(\alpha+\beta) = -1$.

References

[1] Mastroianni G., Russo M.G., Themistoclakis W., *The boundedness of the Cauchy Singular Integral operator in Weighted Besov type spaces with uniform norms,* Integr. eq. oper. theory 43 (2002), 57-89.