A projection based regularized approximation method for ill-posed operator equations

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The problem of solving Fredholm integral equations of the first kind is a prototype of an ill-posed problem of the form $T(x) = y$, where T is a compact operator between Hilbert spaces. Regularization and discretization of such equations is necessary for obtaining stable approximate solutions for such problems. For ill-posed integral equations, a quadrature based collocation method has been considered by Nair (2012) for obtaining discrete regularized approximations. As a generalization, a projection collocation method has been proposed by the author in 2016. In both of the considered methods, the operator T is approximate by a sequence off infinite rank operators. In the present work, we approximate TT^* by finite rank operators. It is found that there are cases where this approach can be better.