ITERATIVE METHODS FOR COMPUTING GENERALIZED INVERSES

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We consider the class of iterative methods for computing generalized inverses $A^{(2)}_{\mathcal{R}(G),\mathcal{N}(G)}$, given by $X_{k+1} = X_k p(AX_k)$ where p is polynomial. These methods generalize well-known hyper-power methods of order r, obtained by taking $p(x) = 1 + x + \ldots + x^{r-1}$. We examine the convergence properties and convergence order of these methods, depending on the polynomial $p(x)$. Moreover, we give the methods with highest possible convergence order, taking a certain number of matrix multiplications per iteration. These results can be efficiently used to improve several methods for finding 1-norm minimal solution of the linear system and have various applications, including image deblurring and compressed sensing.