

A Proposal of Intelligent Variant of GPBiCG_AR Method by Reasonable Determination of Coefficients

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Abstract: Generalized Product Bi-Conjugate Gradient (abbreviated as GPBi-CG) method is an attractive iterative method for the solution of a linear system of equations with non-symmetric coefficient matrix. However, the popularity of GPBi-CG method has diminished over time because of instability of convergence rate. Therefore some variants of GPBi-CG method which have stability of convergence compared with the GPBi-CG method have been proposed. Product-type iterative methods, e.g., GPBi-CG, GPBiCG_AR methods utilize three-term recurrences in the algorithm. Moreover, coefficients ζ_n, η_n included in the accelerated polynomials $H_n(\lambda), G_n(\lambda)$ are computed for every iteration step by means of local minimization of 2-norm of residual r_{n+1} and associate residual $a_r r_{n+1}$. In our talk, we propose intelligent variant of GPBiCG_AR method without and with preconditioning by means of improvement of determination of coefficients ζ_n, η_n . We show the numerical results as below. We can see robustness of intelligent variant of GPBiCG_AR method.

Table 1: Iterations, computation times and ratios of intelligent variant of GPBiCG_AR method with parameter κ .

matrix	GPBi-CG		GPBiCG_AR		Intelligent GPBiCG_AR			
	itr.	time [s]	itr.	time [s]	itr.	time [s]	κ	ratio to AR (GP)
wang4	398	2.82	395	2.61	360	2.09	.00	.80 (.74)
sme3Db	4612	203.2	4738	211.1	3893	170.7	.55	.81 (.84)
memplus	624	3.10	601	2.87	514	2.40	.40	.84 (.77)
comsol	261	0.53	255	0.51	215	0.44	.30	.86 (.83)
wang3	187	1.32	181	1.20	166	1.05	.20	.88 (.80)
poi-3db	161	12.10	162	13.13	154	11.59	.60	.88 (.96)
bjtcai	4058	49.65	3818	45.13	3431	40.11	.10	.89 (.81)
sme3Da	5410	97.44	4028	72.03	3636	64.92	.25	.90 (.67)
epb1	347	1.31	351	1.26	330	1.15	.35	.91 (.83)
af23560	1942	24.57	2058	25.35	1882	23.16	.60	.91 (.94)
epb3	2866	61.46	2647	53.30	2443	49.00	.60	.92 (.80)
xenon1	488	14.86	521	15.44	481	14.22	.75	.92 (.96)
ex19	2237	15.15	2218	14.74	2098	13.91	.15	.94 (.92)
epb2	230	1.59	239	1.57	230	1.45	.60	.94 (.92)
3D_3D	max	–	6344	173.9	6071	165.6	.90	.95 (–)

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