Variants of BiCGCR Iterative Method with Efficient Performance for Complex Symmetric Matrices

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Abstract: Several methods such as COCG, COCR and QMR-SYM have been developed for solving linear systems with complex symmetric coefficient matrices. SCBiCG is also known as one of methods for solving such linear system. SCBiCG can be derived by substituting a matrix polynomial, which is expressed by the complex conjugate coefficient matrix and initial residual vector, to the initial shadow residual of the BiCG algorithm. Some recurrence coefficients can be carried out in the resulting algorithm, but the effective implementations and the corresponding numerical results have not been given in the original paper. Therefore, in our talk we exhibit the effective usage of SCBiCG by comparing several implementations of BiCGCR. Moreover, we clarify that SCBiCG can be transformed to some methods which have been previously proposed. We present efficient performance as below.

Table 1: Performance of COCG, COCR, BiCGCR(ver.1, 2) for acoustic problems.

matrix	frequency	method	iterations	total time[s]	ave. time /itr.[ms]	true res. $\log_{10}(\ )$	ratio
ACOUS	125	COCG	1318	103.29	78.37	-9.01	1.00
		COCR	1287	117.89	91.60	-9.00	1.14
		BiCGCR(ver.1)	293	29.02	99.04	-9.05	0.28
		BiCGCR(ver.2)	286	28.63	100.10	-9.03	0.28
	200	COCG	3284	256.90	78.23	-9.03	1.00
		COCR	3242	295.26	91.07	-9.03	1.15
		BiCGCR(ver.1)	406	39.48	97.24	-9.15	0.15
		BiCGCR(ver.2)	401	39.49	98.48	−9.03	0.15
	250	COCG	4794	377.77	78.80	-9.01	1.00
		COCR	4750	432.08	90.96	-9.02	1.14
		BiCGCR(ver.1)	608	60.23	99.06	-9.02	0.16
		BiCGCR(ver.2)	611	59.99	98.18	-9.02	0.16
	315	COCG	max	-	-	-	-
		COCR	7474	684.59	91.60	-9.07	-
		BiCGCR(ver.1)	410	40.50	98.78	-9.01	-
		BiCGCR(ver.2)	414	41.95	101.33	-9.05	-

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