

***Super Matrix Solver-BLK:***  
**Robust Iterative Matrix Solver**

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# What is *Super Matrix Solver-CLK*?

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- *Super Matrix Solver-CLK* is iterative solver using block relaxation method, which divides matrix into some blocks and incompletely decomposes them.
- *Super Matrix Solver-CLK* stably calculates various matrices such as symmetric/asymmetric double precision real/complex number matrices.

## Pre-processing (Block relaxation method)

### ➤ **Generating Blocks:**

Divides a matrix into blocks of suitable number based on characteristics of matrix and maximum limit of memory usage which is specified by a user.



### ➤ **Obtaining approximate inverse matrices:**

Obtains approximate inverse matrices of all blocks by incomplete LU decomposition.



## Calculating solution

### ➤ **Calculating iteratively**

Chooses residual cutting or CG method automatically, and then calculates solution iteratively.

# Application field of SMS-BLK(1)

Product Name	SMS-AMG	P-ICCG	SMS-BLK
Target Coefficient Matrix	sparse	sparse	sparse
Calculation of Asymmetric problems	Yes	No	Yes
Calculation of Problems with Zero Diagonal elements	No	Yes	Yes
Handling of complex number	No	Yes	Yes
Parallelization	No	SMP	No
Application field	CFD, Electromagnetic analysis	Electromagnetic analysis, CFD, Structural analysis	Structural analysis, CFD

# Application field of SMS-BLK(2)

Analysis field		Matrix type		Handling of different matrix type		
				SMS-AMG	P-ICCG	SMS-BLK (*)
CFD	Symmetric	Real number	Excellent	Good	Good	
		Complex number	-	Good	Good	
	Asymmetric	Real number	Excellent	-	Good	
		Complex number	-	-	Good	
Electromagnetic analysis	Symmetric	Real number	Excellent	Good	Fair-Good	
		Complex number	-	Good	Fair-Good	
	Asymmetric	Real number	Excellent	-	Fair-Good	
		Complex number	-	-	Fair-Good	
Structural Analysis	Solid element (3DOF)	Symmetric	Real number	Good	Good	Good
	Shell element (6DOF)			-	Good	Good

(\*) Regardless of description in the table above, SMS-BLK can not solve problems including an eigenvalue whose value is zero.

# Special features of SMS-BLK

SMS-BLK has the following special features.

## ➤ **General-purpose**

Solves various type of matrices such as symmetric/asymmetric matrices, matrices of real/complex number, matrices with/without zero diagonal elements.

## ➤ **Robust**

The most robust iterative solver, which can solve largest number of matrices we have, in *Super Matrix Solver* series.

## ➤ **Storing pre-processing results (for later reuse)**

Saves setup time in case of calculating multiple right-hand-side vector  $\mathbf{b}$  with fixed coefficient  $\mathbf{A}$ .

# SMS-BLK summary specifications(1)

- **Calculates sparse matrices**
- **Calculates both real and complex number**
- **Calculates matrices with zero diagonal elements**
- **Calculates both symmetric/asymmetric matrices**  
Requires only upper/lower half of a symmetric matrix.
- **Stores pre-processing results**  
Provides not only interface for whole process but also interfaces to operate each of three processes; pre-processing, calculating solution and freeing memory.  
By using these interfaces, saves setup time in case of calculating multiple right-hand-side vector  $\mathbf{b}$  with fixed coefficient  $\mathbf{A}$ . (as mentioned in previous slide)

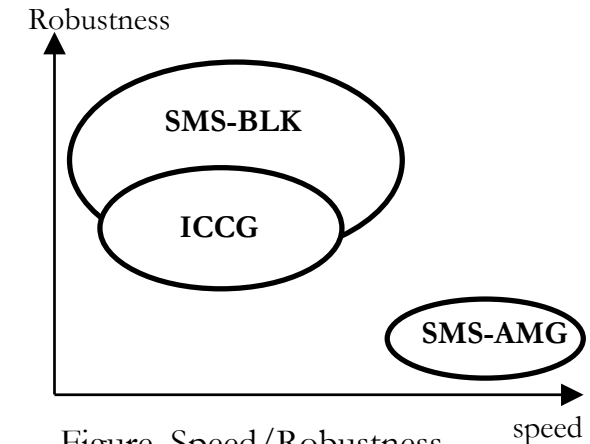


Figure. Speed/Robustness characteristics of solvers in SMS series

(This figure is just concept, not strict.)

## SMS-BLK summary specifications(2)

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- **Operation Environment:** Windows, Linux (just plan, no schedule)
- **Integration:** Available to be integrated to programs written by C and FORTRAN (Use of the other languages have not been verified)
- **Input data:** Coefficient matrix, right-hand side vector, maximum number of iteration, etc
- **Method of Provision:** DLL (Source code will not be disclosed)
- **Attached Materials:** Product manual (with explanations about data format, parameters, integration procedures, etc.), sample data, sample program for integrating SMS-BLK (C and FORTRAN).