Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}\}$
4	$C \to \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix}, A \to \begin{pmatrix} A_L & A_R \end{pmatrix}$ where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns
2	$ \left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right)  $
3	while $m(C_{TL}) < m(C)$ do
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge m(C_{TL}) < m(C) $
5a	$ \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix} \rightarrow \begin{pmatrix} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ C_{20} & c_{21} & C_{22} \end{pmatrix}, \begin{pmatrix} A_L & A_R \end{pmatrix} \rightarrow \begin{pmatrix} A_0 & a_1 & A_2 \end{pmatrix} $ where $\gamma_{11}$ is $1 \times 1$ , $a_1$ has 1 column
6	$ \left\{ \begin{array}{c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ C_{20} & c_{21} & C_{22} \end{array}\right\} = \left(\begin{array}{c c} A_0^T A_0 + \hat{C}_{00} & \hat{c}_{01} & \hat{C}_{02} \\ \hline a_1^T A_0 + \hat{c}_{10}^T & \hat{\gamma}_{11} & \hat{c}_{12}^T \\ A_2^T A_0 + \hat{C}_{20} & \hat{c}_{21} & \hat{C}_{22} \end{array}\right) $
8	$ \gamma_{11} := a_1^T a_1 + \gamma_{11}  c_{21} := A_2^T a_1 + c_{21} $
7	$ \left\{ \begin{array}{c c} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array} \right) = \left( \begin{array}{c c} A_0^T A_0 + \widehat{C}_{00} & A_0^T a_1 + \widehat{c}_{10}^T & \widehat{C}_{02} \\ a_1^T A_0 + \widehat{c}_{10}^T & a_1^T a_1 + \widehat{\gamma}_{11} & \widehat{c}_{12}^T \\ \hline A_2^T A_0 + \widehat{C}_{20} & A_2^T a_1 + \widehat{c}_{21} & \widehat{C}_{22} \end{array} \right) $
5b	$\left( \left. C_{BL} \left  C_{BR} \right. \right) - \left( \left. \left( \left. \left. \left( \left. \left  C_{20} \right  \right  C_{21} \right) \right) \right  \left( \left. \left  \left. \left  C_{22} \right  \right  \right) \right) \right) \right)$
2	$\left\{ \begin{array}{c c} \left( \frac{C_{TL}}{C_{BL}} \begin{vmatrix} C_{TR} \\ C_{BL} \end{vmatrix} C_{BR} \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \begin{vmatrix} \widehat{C}_{TR} \\ \widehat{C}_{BR} \end{vmatrix} \right) \\ \end{array} \right\}$
	endwhile
2,3	$\left\{ \left( \frac{C_{TL}}{C_{BL}} \left  \frac{C_{TR}}{C_{BR}} \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \left  \widehat{C}_{BR} \right) \wedge \neg (m(C_{TL}) < m(C)) \right\} \right\}$
1b	$\{C = A^T A + \widehat{C} $

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$	
1a	{	}
4	where	
2		$\left. \begin{array}{c} \\ \end{array} \right\}$
3	while do	
2,3	^	$\left. \begin{array}{c} \\ \end{array} \right\}$
5a	where	
6		$\left. \begin{array}{c} \\ \end{array} \right\}$
8		
7		$\left.\begin{array}{c} \\ \end{array}\right\}$
5b		
2		$\bigg\}$
	endwhile	
2,3	$\left\{ \begin{array}{c} & & \\ & & \\ & & \end{array} \right.$	$\bigg\}$
1b	{	}

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$	
1a	$\{C=\widehat{C}$	}
4	where	
2		$\left. \right\}$
3	while do	
2,3	\( \)	$\left. ight\}$
5a	where	
6		$\left. \begin{array}{c} \\ \\ \end{array} \right\}$
8		
7		$\left. \right $
5b		
2		$\left. ight\}$
	endwhile	
2,3	$\bigg\{ \qquad \qquad \land \neg ( \qquad )$	$\left. \right\}$
1b	$\{C = A^T A + \widehat{C}$	}

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}\}$
4	where
2	$\left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \right\}$
3	while do
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge \right.$
5a	where
6	
8	
7	
5b	
2	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right)$
	endwhile
2,3	$ \left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \land \neg ( )  $
1b	$\{C = A^T A + \widehat{C} $

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}$
4	where
2	$ \left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) $
3	while $m(C_{TL}) < m(C)$ do
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge m(C_{TL}) < m(C) \end{array} \right\}$
5a	where
6	
8	
7	
5b	
2	$\left\{ \begin{array}{c c} \left( \frac{C_{TL}}{C_{BL}} \left  C_{TR} \right  \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \left  \widehat{C}_{BR} \right  \right) \\ \end{array} \right\}$
	endwhile
2,3	$\left\{ \left( \frac{C_{TL}}{C_{BL}} \middle  C_{TR} \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \middle  \widehat{C}_{BR} \right) \land \neg (m(C_{TL}) < m(C)) \right\}$
1b	$\{C = A^T A + \widehat{C} $

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}$
4	$C  o \left( egin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \\ \end{array}  ight), \ A  o \left( \left. A_L \right  A_R \right)$ where $C_{TL}$ is $0  imes 0$ , $A_L$ has $0$ columns
2	where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns $ \left\{ \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix} = \begin{pmatrix} A_L^T A_L + \hat{C}_{TL} & \hat{C}_{TR} \\ A_R^T A_L + \hat{C}_{BL} & \hat{C}_{BR} \end{pmatrix} \right\} $
3	while $m(C_{TL}) < m(C)$ do
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right\} = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge m(C_{TL}) < m(C) $
5a	where
6	
8	
7	
5b	
2	$\left\{ \begin{array}{c c} \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \end{array} \right\}$
	endwhile
2,3	$ \left\{ \left( \frac{C_{TL}}{C_{BL}} \left  C_{TR} \right  \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \left  \widehat{C}_{BR} \right  \right) \land \neg (m(C_{TL}) < m(C)) \right\} $
1b	$\left\{ C = A^T A + \widehat{C} \right\}$

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	${C = \widehat{C}}$
4	$C \to \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right), A \to \left(\begin{array}{c c} A_L & A_R \end{array}\right)$ where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns
2	$ \left\{ \left( \frac{C_{TL}}{C_{BL}} \begin{vmatrix} C_{TR} \\ C_{BL} \end{vmatrix} \right) = \left( \frac{A_L^T A_L + \hat{C}_{TL}}{A_R^T A_L + \hat{C}_{BL}} \begin{vmatrix} \hat{C}_{TR} \\ \hat{C}_{BR} \end{vmatrix} \right) \right\} $
3	while $m(C_{TL}) < m(C)$ do
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge m(C_{TL}) < m(C)$
5a	$ \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c} A_L & A_R \end{array}\right) \rightarrow \left(\begin{array}{c c} A_0 & a_1 & A_2 \end{array}\right) $ where $\gamma_{11}$ is $1 \times 1$ , $a_1$ has 1 column
6	
8	
7	
5b	$ \left(\begin{array}{c c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c c} A_L & A_R \end{array}\right) \leftarrow \left(\begin{array}{c c c} A_0 & a_1 & A_2 \end{array}\right) $
2	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right)$
	endwhile
2,3	$\left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \land \neg (m(C_{TL}) < m(C))$
1b	$\left\{ C = A^T A + \widehat{C} \right\}$

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}$
4	$C \to \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right), A \to \left(\begin{array}{c c} A_L & A_R \end{array}\right)$ where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns
2	$ \left\{ \left( \frac{C_{TL}}{C_{BL}} \left  \frac{C_{TR}}{C_{BR}} \right) = \left( \frac{A_L^T A_L + \hat{C}_{TL}}{A_R^T A_L + \hat{C}_{BL}} \left  \hat{C}_{BR} \right) \right. \right\} $
3	while $m(C_{TL}) < m(C)$ do
2,3	$ \left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \land m(C_{TL}) < m(C) $
5a	$ \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \to \left(\begin{array}{c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c} A_L & A_R \end{array}\right) \to \left(\begin{array}{c c} A_0 & a_1 & A_2 \end{array}\right) $
6	$ \begin{cases} \frac{C_{00}}{c_{01}} & c_{01} & C_{02} \\ \hline c_{10}^{T} & \gamma_{11} & c_{12}^{T} \\ C_{20} & c_{21} & C_{22} \end{cases} = \begin{pmatrix} \frac{A_{0}^{T} A_{0} + \widehat{C}_{00}}{a_{1}^{T} A_{0} + \widehat{C}_{10}} & \widehat{c}_{01} & \widehat{C}_{02} \\ \hline a_{1}^{T} A_{0} + \widehat{c}_{10}^{T} & \widehat{\gamma}_{11} & \widehat{c}_{12}^{T} \\ A_{2}^{T} A_{0} + \widehat{C}_{20} & \widehat{c}_{21} & \widehat{C}_{22} \end{pmatrix} $
8	
7	
5b	$ \left(\begin{array}{c c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c c} A_L & A_R \end{array}\right) \leftarrow \left(\begin{array}{c c c} A_0 & a_1 & A_2 \end{array}\right) $
2	$ \left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) $
	endwhile
2,3	$\left\{ \left( \frac{C_{TL}}{C_{BL}} \begin{vmatrix} C_{TR} \\ C_{BL} \end{vmatrix} \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \begin{vmatrix} \widehat{C}_{TR} \\ \widehat{C}_{BR} \end{vmatrix} \right) \land \neg (m(C_{TL}) < m(C)) $
1b	$\{C = A^T A + \widehat{C} $

Step	Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
1a	$\{C = \widehat{C}\}$
4	$C \to \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix}, A \to \begin{pmatrix} A_L & A_R \end{pmatrix}$ where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns
2	$ \left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) $
3	while $m(C_{TL}) < m(C)$ do
2,3	$ \left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \land m(C_{TL}) < m(C) $
5a	$ \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix} \rightarrow \begin{pmatrix} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ C_{20} & c_{21} & C_{22} \end{pmatrix}, \begin{pmatrix} A_L & A_R \end{pmatrix} \rightarrow \begin{pmatrix} A_0 & a_1 & A_2 \end{pmatrix} $ where $\gamma_{11}$ is $1 \times 1$ , $a_1$ has 1 column
6	$ \begin{cases} \begin{pmatrix} C_{00} & c_{01} & C_{02} \\ c_{10}^{T} & \gamma_{11} & c_{12}^{T} \\ C_{20} & c_{21} & C_{22} \end{pmatrix} = \begin{pmatrix} A_{0}^{T} A_{0} + \hat{C}_{00} & \hat{c}_{01} & \hat{C}_{02} \\ a_{1}^{T} A_{0} + \hat{c}_{10}^{T} & \hat{\gamma}_{11} & \hat{c}_{12}^{T} \\ A_{2}^{T} A_{0} + \hat{C}_{20} & \hat{c}_{21} & \hat{C}_{22} \end{pmatrix} $
8	
7	$ \left\{ \begin{array}{c c} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right\} = \left(\begin{array}{c c} A_0^T A_0 + \widehat{C}_{00} & A_0^T a_1 + \widehat{c}_{10}^T & \widehat{C}_{02} \\ a_1^T A_0 + \widehat{c}_{10}^T & a_1^T a_1 + \widehat{\gamma}_{11} & \widehat{c}_{12}^T \\ \hline A_2^T A_0 + \widehat{C}_{20} & A_2^T a_1 + \widehat{c}_{21} & \widehat{C}_{22} \end{array}\right) $
5b	$ \left(\begin{array}{c c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c c c} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c c} A_L & A_R \end{array}\right) \leftarrow \left(\begin{array}{c c c} A_0 & a_1 & A_2 \end{array}\right) $
2	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right)$
	endwhile
2,3	$ \left\{ \left( \frac{C_{TL}}{C_{BL}} \middle  C_{TR} \right) = \left( \frac{A_L^T A_L + \widehat{C}_{TL}}{A_R^T A_L + \widehat{C}_{BL}} \middle  \widehat{C}_{TR} \right) \land \neg (m(C_{TL}) < m(C)) \right\} $
1b	$\{C = A^T A + \widehat{C} $

Step	Algorithm: $[C] := SYRK_LT_UNB_VAR3(A, C)$	
1a	$\{C=\widehat{C}$	}
4	$C  o \left( \frac{C_{TL} \mid C_{TR}}{C_{BL} \mid C_{BR}} \right), A  o \left( A_L \mid A_R \right)$	
2	where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns $ \left\{ \begin{pmatrix} C_{TL} & C_{TR} \\ C_{BL} & C_{BR} \end{pmatrix} = \begin{pmatrix} A_L^T A_L + \hat{C}_{TL} & \hat{C}_{TR} \\ A_R^T A_L + \hat{C}_{BL} & \hat{C}_{BR} \end{pmatrix} \right. $	
3	while $m(C_{TL}) < m(C)$ do	
2,3	$\left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right\} = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \wedge m(C_{TL}) < m(C)$	
5a	$ \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \to \left(\begin{array}{c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c} A_L & A_R \end{array}\right) \to \left(\begin{array}{c c} A_0 & a_1 & A_2 \end{array}\right) $	
6	$ \begin{cases} \frac{C_{00}}{c_{01}} & c_{01} & C_{02} \\ \hline c_{10}^{T} & \gamma_{11} & c_{12}^{T} \\ C_{20} & c_{21} & C_{22} \end{cases} = \begin{pmatrix} \frac{A_{0}^{T} A_{0} + \widehat{C}_{00}}{a_{1}^{T} A_{0} + \widehat{C}_{10}} & \widehat{c}_{01} & \widehat{C}_{02} \\ \hline a_{1}^{T} A_{0} + \widehat{c}_{10}^{T} & \widehat{\gamma}_{11} & \widehat{c}_{12}^{T} \\ A_{2}^{T} A_{0} + \widehat{C}_{20} & \widehat{c}_{21} & \widehat{C}_{22} \end{pmatrix} $	$\left. \begin{array}{c} - \\ \end{array} \right\}$
8	$ \gamma_{11} := a_1^T a_1 + \gamma_{11}  c_{21} := A_2^T a_1 + c_{21} $	
7	$ \begin{cases} \begin{pmatrix} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ C_{20} & c_{21} & C_{22} \end{pmatrix} = \begin{pmatrix} A_0^T A_0 + \widehat{C}_{00} & A_0^T a_1 + \widehat{c}_{10}^T & \widehat{C}_{02} \\ a_1^T A_0 + \widehat{c}_{10}^T & a_1^T a_1 + \widehat{\gamma}_{11} & \widehat{c}_{12}^T \\ A_2^T A_0 + \widehat{C}_{20} & A_2^T a_1 + \widehat{c}_{21} & \widehat{C}_{22} \end{pmatrix} $	
5b	$\left( egin{array}{c c} C_{BL} & C_{BR} \end{array} \right) = \left( egin{array}{c c} C_{20} & c_{21} & C_{22} \end{array} \right)$	
2	$ \left\{ \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) $	
	endwhile	
2,3	$\left\{ \left( \begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array} \right) = \left( \begin{array}{c c} A_L^T A_L + \widehat{C}_{TL} & \widehat{C}_{TR} \\ \hline A_R^T A_L + \widehat{C}_{BL} & \widehat{C}_{BR} \end{array} \right) \land \neg (m(C_{TL}) < m(C))$	$\left. \right\}$
1b	$\{C = A^T A + \widehat{C}$	}

Algorithm: $[C] := \text{SYRK\_LT\_UNB\_VAR3}(A, C)$
$C \to \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right), A \to \left(\begin{array}{c c} A_L & A_R \end{array}\right)$ where $C_{TL}$ is $0 \times 0$ , $A_L$ has 0 columns
while $m(C_{TL}) < m(C)$ do
$ \left(\begin{array}{c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c} A_L & A_R \end{array}\right) \rightarrow \left(\begin{array}{c c} A_0 & a_1 & A_2 \end{array}\right) $ where $\gamma_{11}$ is $1 \times 1$ , $a_1$ has 1 column
$ \gamma_{11} := a_1^T a_1 + \gamma_{11}  c_{21} := A_2^T a_1 + c_{21} $
$ \left(\begin{array}{c c c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c c c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c c c} A_L & A_R \end{array}\right) \leftarrow \left(\begin{array}{c c c} A_0 & a_1 & A_2 \end{array}\right) $
endwhile

Algorithm:  $[C] := SYRK_LT_UNB_VAR3(A, C)$ 

$$C \to \left(\begin{array}{c|c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) , A \to \left(\begin{array}{c|c} A_L & A_R \end{array}\right)$$

where  $C_{TL}$  is  $0 \times 0$ ,  $A_L$  has 0 columns

while  $m(C_{TL}) < m(C)$  do

$$\left(\begin{array}{c|c|c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \to \left(\begin{array}{c|c|c} C_{00} & c_{01} & C_{02} \\ \hline c_{10}^T & \gamma_{11} & c_{12}^T \\ C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c|c|c} A_L & A_R \end{array}\right) \to \left(\begin{array}{c|c|c} A_0 & a_1 & A_2 \end{array}\right)$$

where  $\gamma_{11}$  is  $1 \times 1$ ,  $a_1$  has 1 column

$$\gamma_{11} := a_1^T a_1 + \gamma_{11}$$

$$c_{21} := A_2^T a_1 + c_{21}$$

$$\left(\begin{array}{c|c|c} C_{TL} & C_{TR} \\ \hline C_{BL} & C_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} C_{00} & c_{01} & C_{02} \\ c_{10}^T & \gamma_{11} & c_{12}^T \\ \hline C_{20} & c_{21} & C_{22} \end{array}\right), \left(\begin{array}{c|c|c} A_L & A_R \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_0 & a_1 & A_2 \end{array}\right)$$

endwhile