For easy navigation the enumeration in the Table of Contents, and the "(to ToC)" right after the section names are the forward and backward hyperlinks between Table of Contents and the beginning of sections.

Contents

1 Skeleton of CholDDcBlockTriD() *(to ToC)*

```
CholDDcBlockTriD(){
}
```

2 CholDDcBlockTriD() *(to ToC)*

2.1 Formal parameters *(to ToC)*

Type	ID	*Math*	*Comment*
double	*K		
double	*D		
int	n		

2.2 Return values *(to ToC)*

0 - upon success;
1 - if failed;

2.3 Description *(to ToC)*

2.4 Block tridiagonal matrix *(to ToC)*

The following recursive relations apply for the entries of D and L:

$$
\begin{aligned}
&D_i = A_{ii} - \sum_{k=0}^{k<i} L_{ik}^2 D_k, \quad L_{ij} = \frac{1}{D_j}\left(A_{ij} - \sum_{k=0}^{k<j} L_{ik}L_{jk}D_k\right), \quad \text{for } j<i<n, \\
&D_i = A_{ii} - \sum_{k=0}^{k<i} L_{ik}^2 D_k, \quad L_{ji} = \frac{1}{D_i}\left(A_{ji} - \sum_{k=0}^{k<i} L_{jk}L_{ik}D_k\right), \quad \text{for } i<j<n, \\
&D_0 = A_{00}, \quad L_{10} = \frac{1}{D_0}A_{10}, \quad L_{20} = 0, \quad L_{30} = 0, \quad \ldots, \\
&D_1 = A_{11} - L_{10}^2 D_0, \quad L_{21} = \frac{1}{D_1}A_{21}, \quad L_{31} = \frac{1}{D_1}A_{31} = 0, \quad \ldots, \\
&D_2 = A_{22} - L_{21}^2 D_1, \quad L_{32} = \frac{1}{D_2}\left(A_{32} - L_{31}L_{21}D_1\right), \quad L_{42} = 0, \quad \ldots.
\end{aligned}
\tag{2.1}
$$

The tokens of the matrix corresponding to the Hermit finite elements are $K \times K$ matrices. For 2-D case $K = 4$, for 3-D $K = 8$. These matrices compose a tri-diagonal $M \times M$ matrices, corresponding to the radial a-coordinate, with M equal to the number of radial vertexes.

Then, these radial matrices compose a periodic tri-diagonal $N \times N$ matrix, corresponding to the poloidal coordinate θ.

In 3-D case, these poloidal matrices compose a periodic tri-diagonal $L \times L$ matrix, corresponding to the toroidal coordinate ζ.

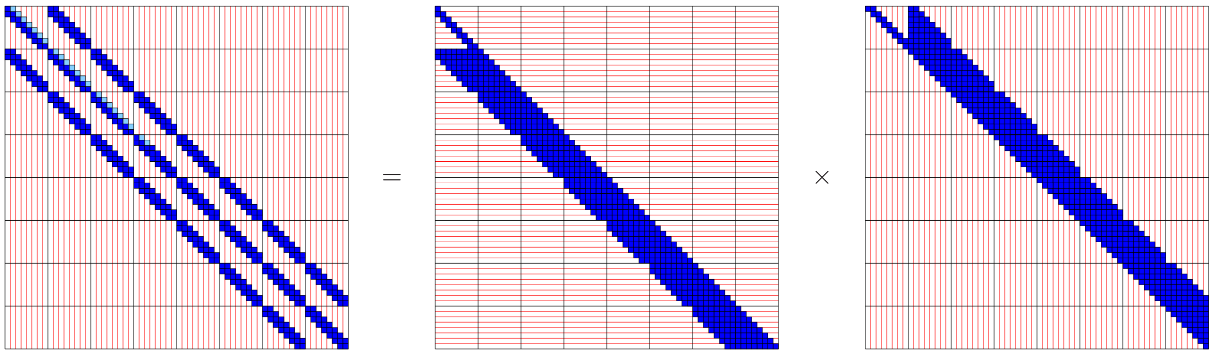
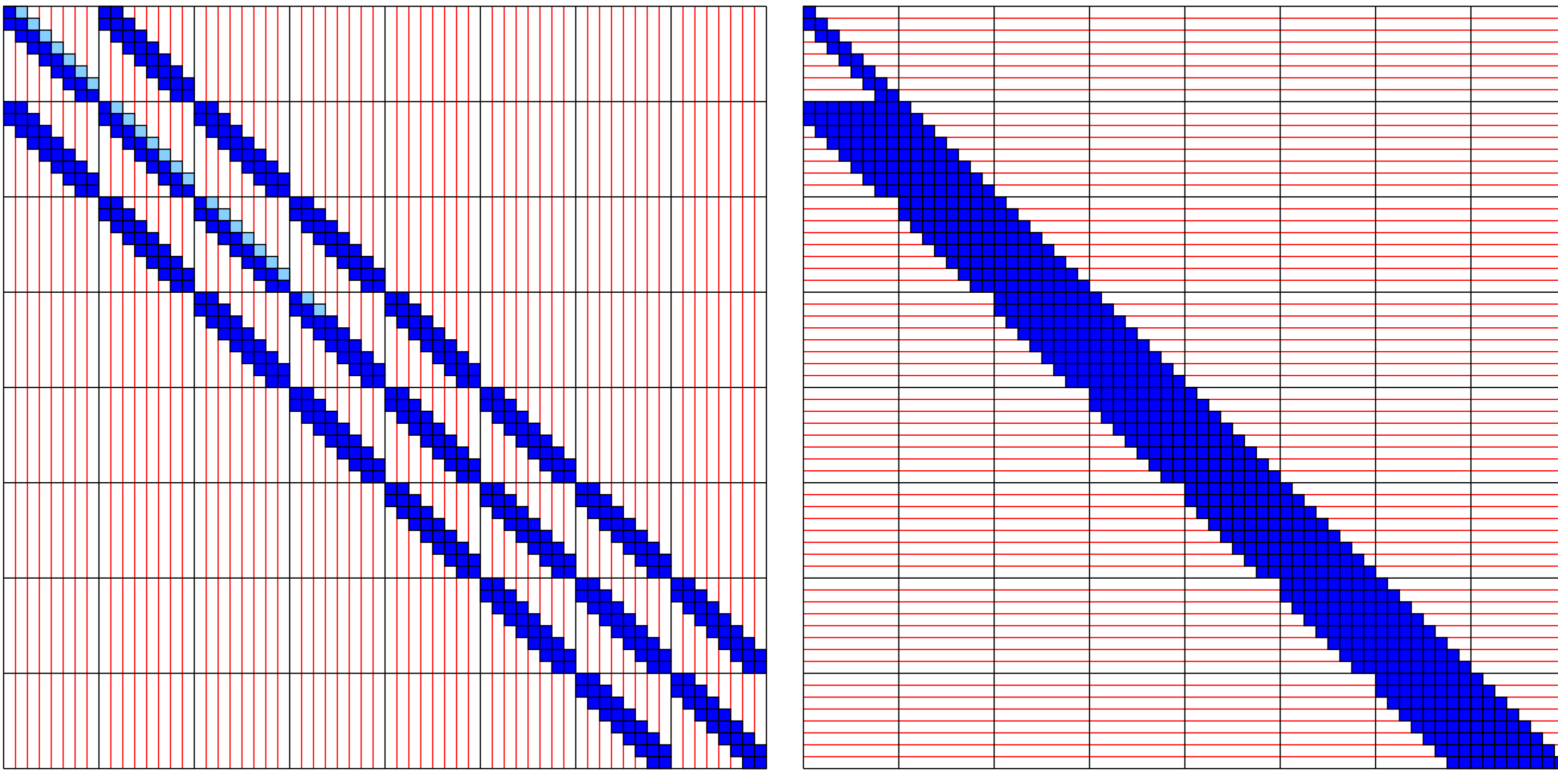


Fig.1. The structure of Cholesky triangular matrices for a tri-diagonal positive symmetric matrix



The resulting triangular matrix contains

2.5 Block tridiagonal matrix with periodic conditions *(to ToC)*

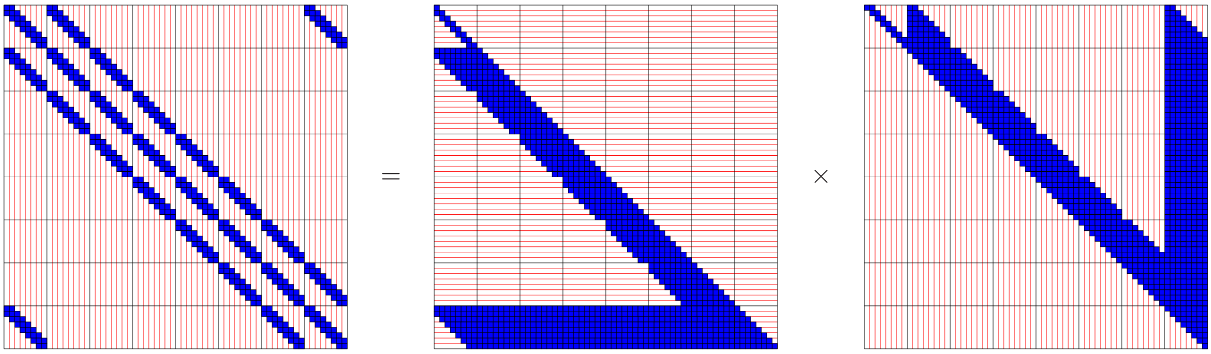


Fig.2. The structure of Cholesky triangular matrices for a periodic tri-diagonal positive symmetric matrix

2.6 Matrix Cholesky *(to ToC)*

$$
\begin{aligned}
\mathsf{A} = \mathsf{L}\mathsf{D}\mathsf{L}^T &= \begin{pmatrix} \mathsf{I} & 0 & 0 \\ \mathsf{L}_{10} & \mathsf{I} & 0 \\ \mathsf{L}_{20} & \mathsf{L}_{21} & \mathsf{I} \end{pmatrix} \begin{pmatrix} \mathsf{D}_0 & 0 & 0 \\ 0 & \mathsf{D}_1 & 0 \\ 0 & 0 & \mathsf{D}_2 \end{pmatrix} \begin{pmatrix} \mathsf{I} & \mathsf{L}_{10}^T & \mathsf{L}_{20}^T \\ 0 & \mathsf{I} & \mathsf{L}_{21}^T \\ 0 & 0 & \mathsf{I} \end{pmatrix} \\
&= \begin{pmatrix} \mathsf{I} & 0 & 0 \\ \mathsf{L}_{10} & \mathsf{I} & 0 \\ \mathsf{L}_{20} & \mathsf{L}_{21} & \mathsf{I} \end{pmatrix} \begin{pmatrix} \mathsf{D}_0 & \mathsf{D}_0\mathsf{L}_{10}^T & \mathsf{D}_0\mathsf{L}_{20}^T \\ 0 & \mathsf{D}_1 & \mathsf{D}_1\mathsf{L}_{21}^T \\ 0 & 0 & \mathsf{D}_2 \end{pmatrix} \\
&= \begin{pmatrix} \mathsf{D}_0 & \mathsf{D}_0\mathsf{L}_{10}^T & \mathsf{D}_0\mathsf{L}_{20}^T \\ & \mathsf{L}_{10}\mathsf{D}_0\mathsf{L}_{10}^T + \mathsf{D}_1 & \mathsf{L}_{20}\mathsf{D}_0\mathsf{L}_{10}^T + \mathsf{D}_1\mathsf{L}_{21}^T \\ \text{(symmetrical)} & & \mathsf{L}_{20}\mathsf{D}_0\mathsf{L}_{20}^T + \mathsf{L}_{21}\mathsf{D}_1\mathsf{L}_{21}^T + \mathsf{D}_2 \end{pmatrix} \\
&= \begin{pmatrix} \mathsf{A}_{00} & \mathsf{A}_{11} & \mathsf{A}_{02} \\ & \mathsf{A}_{11} & \mathsf{A}_{12} \\ \text{(symmetrical)} & & \mathsf{A}_{22} \end{pmatrix}, \\
\mathsf{D} &= \begin{pmatrix} \mathsf{A}_{00} & 0 & 0 \\ 0 & \mathsf{A}_{11} - \mathsf{A}_{01}\mathsf{D}_0^{-1}\mathsf{A}_{01} & 0 \\ 0 & 0 & \mathsf{A}_{22} - (\mathsf{A}_{12} - \mathsf{A}_{02}\mathsf{L}_{10})\mathsf{L}_{21} \end{pmatrix}, \\
\mathsf{L} &= \begin{pmatrix} \mathsf{I} & \mathsf{A}_{01}\mathsf{D}_0^{-1} & \mathsf{A}_{02}\mathsf{D}_0^{-1} \\ & \mathsf{I} & (\mathsf{A}_{12} - \mathsf{A}_{02}\mathsf{L}_{10})\mathsf{D}_1^{-1} \\ \text{(symmetrical)} & & \mathsf{I} \end{pmatrix}.
\end{aligned}
\tag{2.2}
$$

2.7 Algorithm *(to ToC)*

2.8 Input *(to ToC)*

Type	ID	*Math*	*Comment*

2.9 Output *(to ToC)*

`Type`	`ID`	*Math*	*Comment*

2.10 ToDo *(to ToC)*

1.

2.11 References *(to ToC)*