Short report on the Rv matrix computation in C++

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This example displays the results of the implemented C++ routines to obtain the Reduced Node Matrix, Rv. The example is based on the geometry displayed in Figure 1, where two equally sized patches with different discretization 'shares' two nodes (node 2 = 9 and 8 = 13).

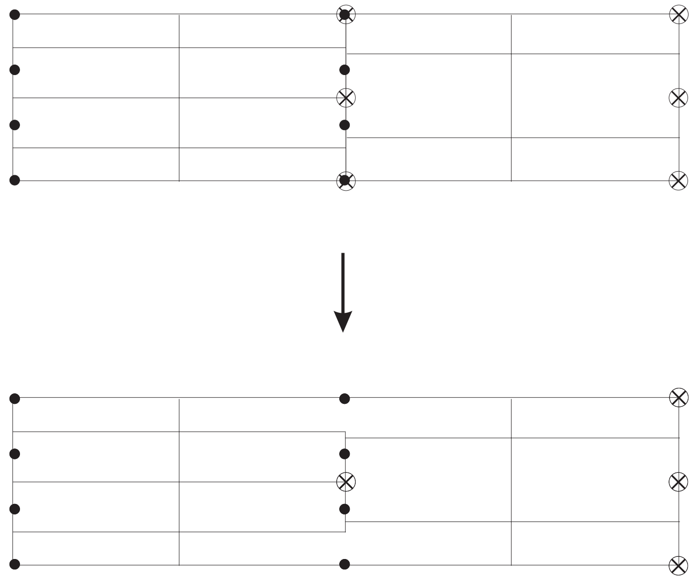

Figure 1: The capacitive partition for the two example patches

The corresponding Rv matrix is then,

$$
\begin{array}{l}
[1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0] \\
[0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0] \\
[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1]
\end{array}
$$

The Rv matrix reduces the original 14 nodes, with two pairs shared, to 12 different nodes. To check the validity of the Rv matrix reduction one can check the node charge before and after the reduction. If Q and Q' describe the node charge before and after the reduction respectively the sum of the elements should be equal, i.e. sum(Q) = sum(Q'). If for example

$$Q = \begin{bmatrix} 0.9501 \\ 0.2311 \\ 0.6068 \\ 0.4860 \\ 0.8913 \\ 0.7621 \\ 0.4565 \\ 0.0185 \\ 0.8214 \\ 0.4447 \\ 0.6154 \\ 0.7919 \\ 0.9218 \\ 0.7382 \end{bmatrix}$$

With sum(Q)=8.736. Then $Q\prime = Rv^T \cdot Q$. In MatLab this gives,

$$Q' = \begin{bmatrix} 0.9501 \\ 1.0525 \\ 0.6068 \\ 0.4860 \\ 0.8913 \\ 0.7621 \\ 0.4565 \\ 0.9403 \\ 0.4447 \\ 0.6154 \\ 0.7919 \\ 0.7382 \\ 0 \\ 0 \end{bmatrix}$$

With sum($Q\prime$)=8.736. Noted in Q' is the reduced nodes, the 13th and 14th, indicated with zero charge.