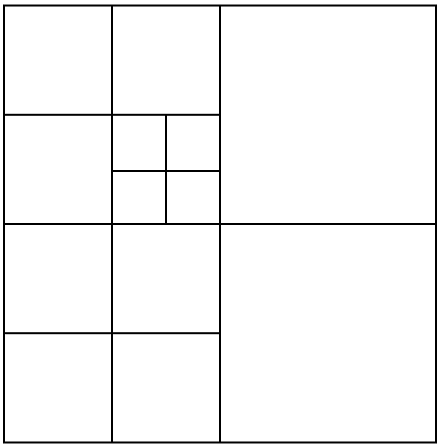
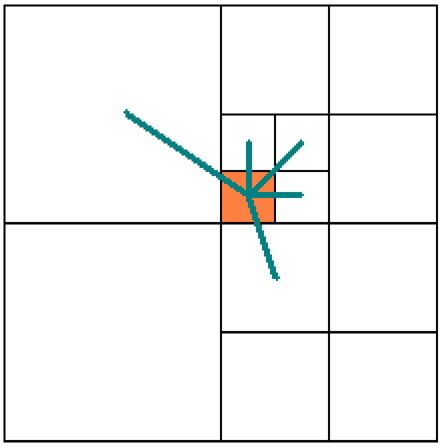
For a cell with configuration as follows:



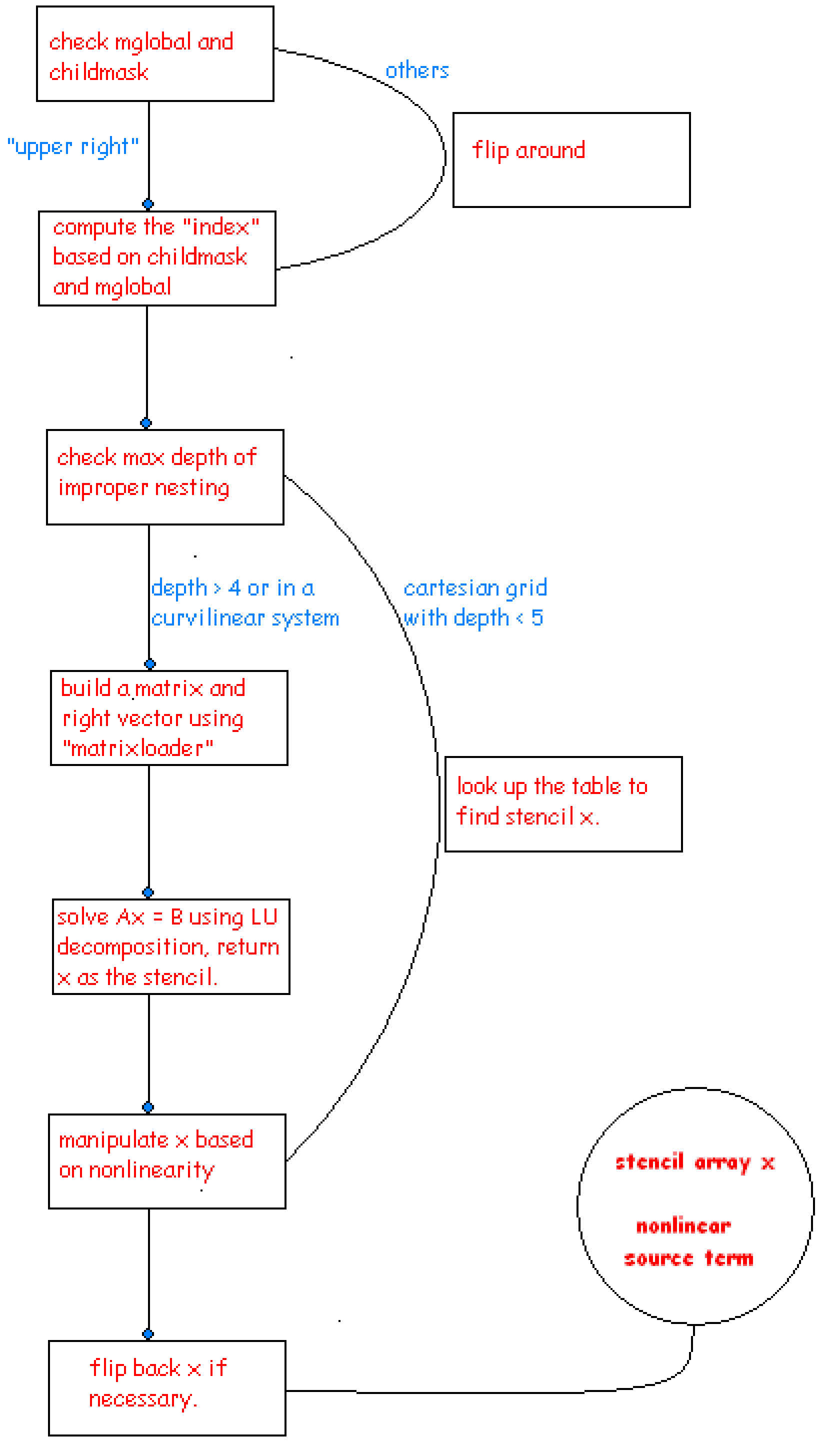
First the cell and its surrounding cells are flipped around to ensure the cells on the same level are located on upper-right:



The different patterns of the above configurations are indexed by the left/down information.
For improper nesting depth < 5 (for 2D. For 3D, max depth should be smaller than 3), look for the table to return the stencil coefficients. For more complicated situations, a function calc_coeffs is called. This function returns the stencil coefficients given mglobal and dimensions. Inside calc_coeffs, matrixloader is called which loads the matrix A and vector B (based on dimensions and coordinate system) in the equation Ax = B.

In 2D, x has 6 dimensions, for 3D, x has 10 dimensions. The linear system is solved by using Crout's algorithm to do a LU decomposition with partial pivoting on matrix A then using backward substitution to find x. This method is introduced in the book “Numerical Recipes”. The tolerance is set to be 10e-16. For cylindrical system, A and B both depend on r, which can be computed from mglobal, thus matrixloader will be called at all cells.

Once the stencil coefficients (stored in a 9-array for 2D, 19-array for 3D) are returned, this array is flipped back. For a nonlinear system, the stencil coefficients array is then manipulated according to the temperature in the surrounding 9 cells. Also, a source term generated by the Taylor expansion is returned. This source term should be coupled to the right-hand side vector in setting up the solution vector. The whole process is shown in the flow chart:


check mglobal and childmask
others
flip around
"upper right"
compute the "index" based on childmask and mglobal
check max depth of improper nesting
depth > 4 or in a curvilinear system
cartesian grid with depth < 5
build a matrix and right vector using "matrixloader"
look up the table to find stencil x.
solve Ax = B using LU decomposition, return x as the stencil.
manipulate x based on nonlinearity
stencil array x
nonlinear source term
flip back x if necessary.