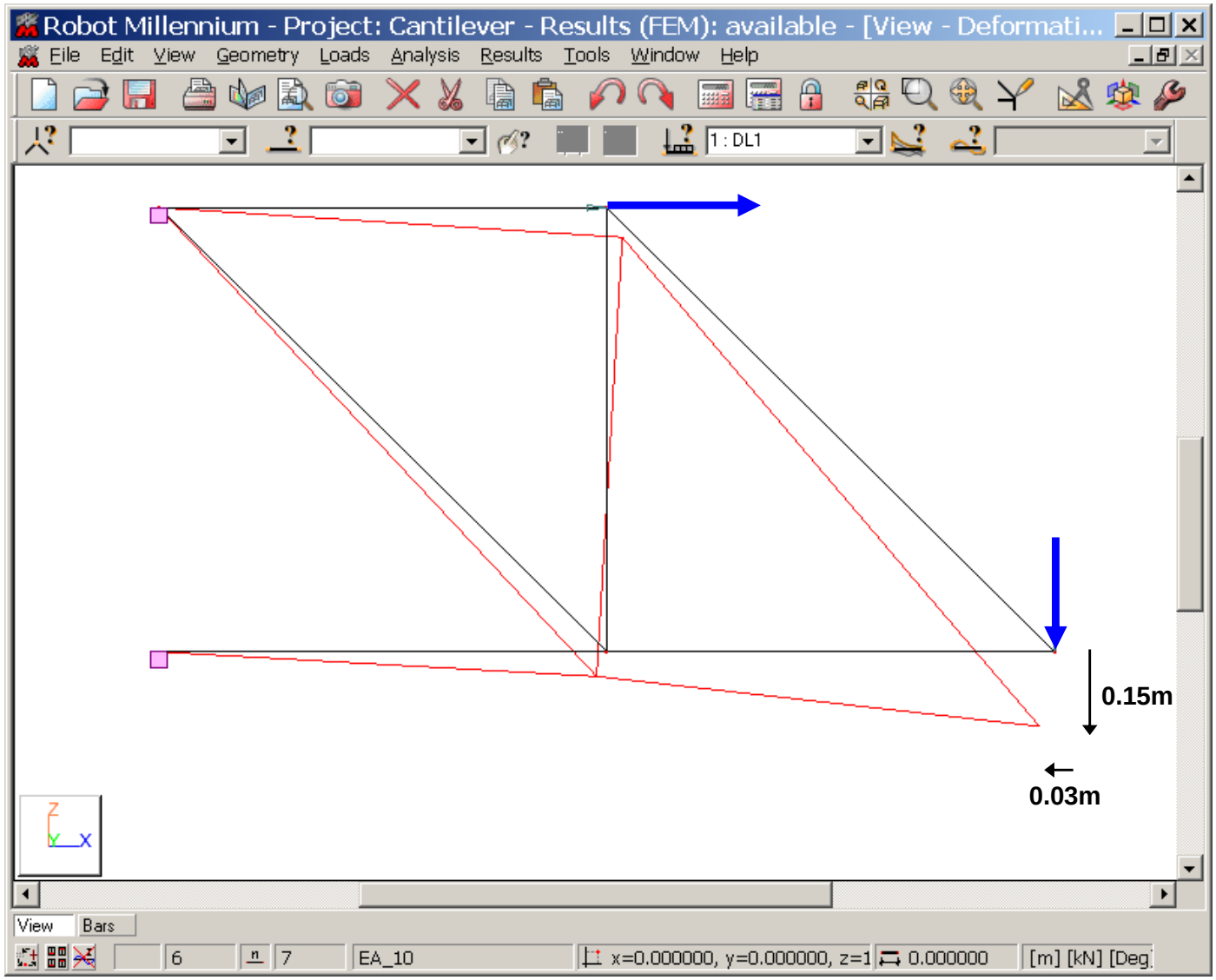
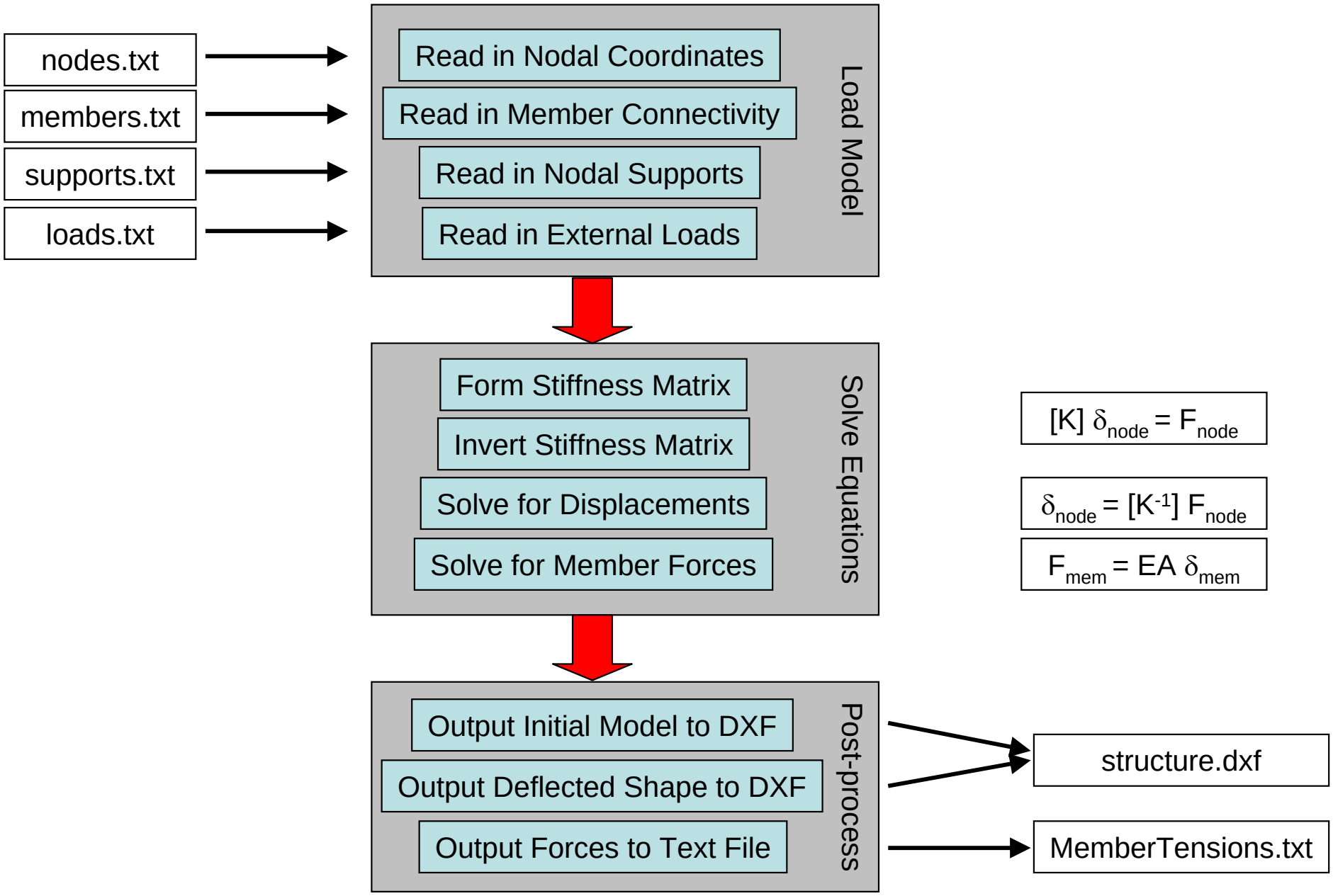
2D Pinned Truss Analysis

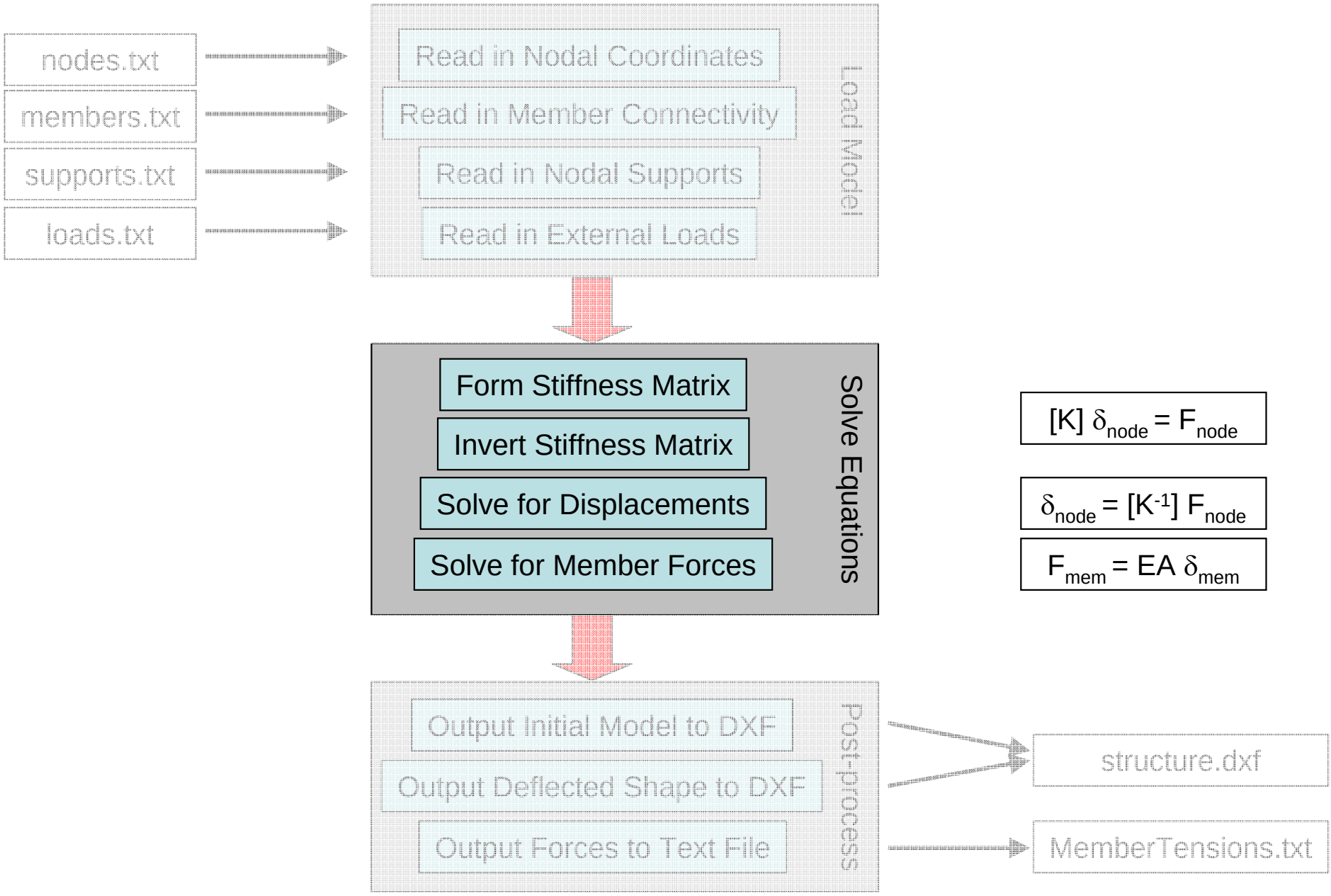


http://staff.bath.ac.uk/abscjkw/ComputerPrograms/C++programs/2Dpinned.zip

What You Need To Be Able To Do

- 2D-Pinned Mathematics
  - How to calculate the member forces
  - How to form the stiffness matrix
  - How to invert a matrix
- 2D-Pinned Computer Program
  - How to read in data files
  - How to write out a DXF file
  - How to represent a “structure” in the computer
  - How to solve a 2D-Pinned analysis





The Maths

$$K\,d = F$$

$$d = \frac{1}{K} F$$

$$\underline{d} = \left[K^{-1}\right]\underline{F}$$

The Matrix

$$K \quad d = F$$

$$\begin{bmatrix} k_{x_1x_1} & k_{x_1y_1} & k_{x_1x_2} & k_{x_1y_2} & \cdots & k_{x_1x_n} & k_{x_1y_n} \\ k_{y_1x_1} & k_{y_1y_1} & k_{y_1x_2} & k_{y_1y_2} & \cdots & k_{y_1x_n} & k_{y_1y_n} \\ k_{x_2x_1} & k_{x_2y_1} & k_{x_2x_2} & k_{x_2y_2} & \cdots & k_{x_2x_n} & k_{x_2y_n} \\ k_{y_2x_1} & k_{y_2y_1} & k_{y_2x_2} & k_{y_2y_2} & \cdots & k_{y_2x_n} & k_{y_2y_n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ k_{x_nx_1} & k_{x_ny_1} & k_{x_nx_2} & k_{x_ny_2} & \cdots & k_{x_nx_n} & k_{x_ny_n} \\ k_{y_nx_1} & k_{y_ny_1} & k_{y_nx_2} & k_{y_ny_2} & \cdots & k_{y_nx_n} & k_{y_ny_n} \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \\ x_2 \\ y_2 \\ \vdots \\ x_n \\ y_n \end{bmatrix} = \begin{bmatrix} f_{x_1} \\ f_{y_1} \\ f_{x_2} \\ f_{y_2} \\ \vdots \\ f_{x_n} \\ f_{y_n} \end{bmatrix}$$

Summary

- We need to read in the data
  - Nodal coordinates
  - Member connectivities
  - Supports
  - Loads
- We need to do the maths
  - Build the stiffness matrix
  - Apply the boundary conditions
  - Invert the matrix
  - Solve for the displacements
  - Solve for member forces
- We need to output our findings
  - DXF of initial structure
  - DXF of deflected structure
  - Text file of member forces