Thermal effects in 2D and 3D FEM

Submitted for the partial fulfillment for me 237

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Introduction

- Thermal Expansion

1. Change in length of element considered in direction along the axis of element.
2. Coefficient of thermal expansion is predefined in program but can be asked by the user as input.

- Change in young's modulus

1. Given in the file defined by user.
2. Change in young's modulus can be calculated afterwards.

2D Code for Thermal Effect

- Equation L_{th}(expanded length)=$L_o(1+\alpha(T-T_o))$
- Element Temp

Temperature Input

Element temperature are given in elem.dat file in the last column 7.

- Ambient Temperature is asked during the run of program.

3 D Code for Thermal Effect

- Element File:-

  Temperature Input.

  Element Temperature in the element file

- Ambient Temperature at the running of program

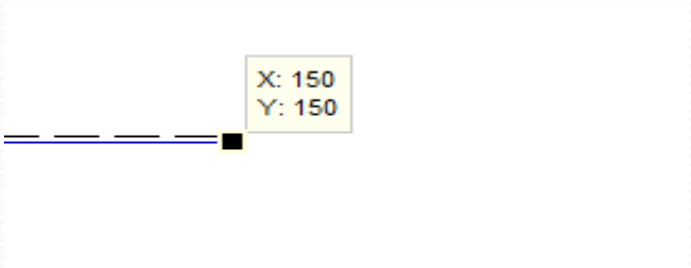
Matlab Program Structure

- Loading of input file from user.
- Calculation the length of each element.
- Plotting the initial configuration.
- Passing the length ,coordinates of nodes ,etc.
- Calculating the change in length of elements.
- Applying the boundary condition.
- Calculating he new node coordinates.
- Returning the new coordinate for FEM.

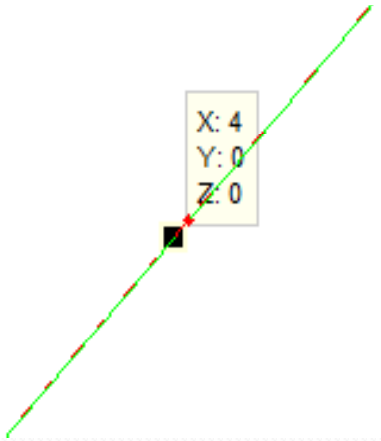
Result

Initial positon of node as indicated

2D FEM ⟶

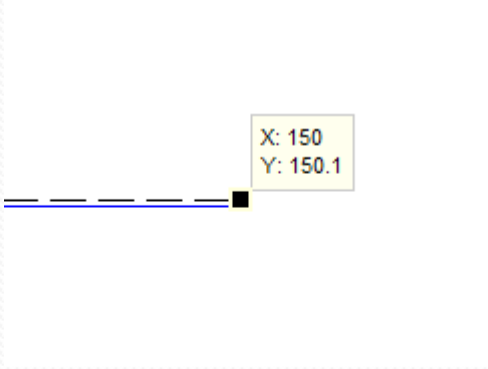


3D FEM ⟶

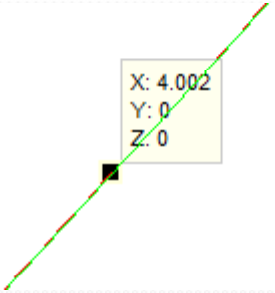


After Thermal Expansion

2D Thermal Expansion

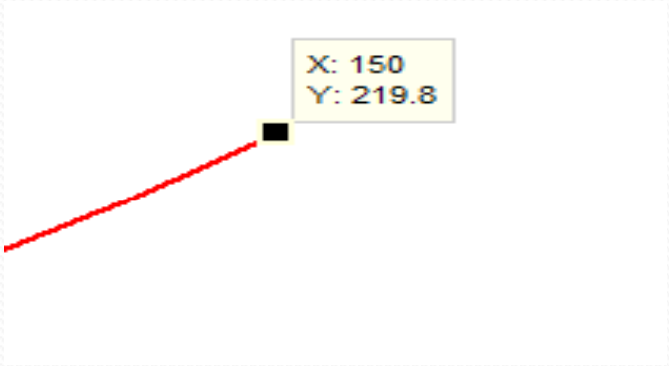


3D Thermal Expansion

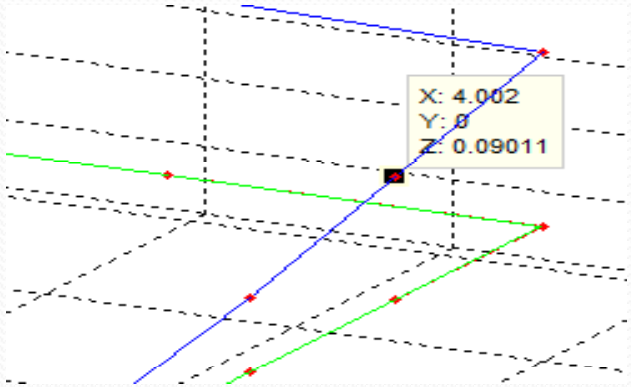


FEM result after thermal expansion

2d FEM →



3d FEM →



Conclusion

- Thermal effects are included successfully in FEM program.

Questions ?