Nonlinear analysis – Assignment 3

**Part A: The Newton Raphson method, applied to a linear material with a non-linear geometric behaviour**

The same method used in assignment 2 is used.

However, the geometric behaviour of the bars is non-linear, therefore the length of the bars varies over time. At each iteration, each length is calculated according to the displacements.

Furthermore, the resisting force in each bar is calculated differently as the strain of a bar subjected to a change in length L-L0 is: Wint=0.5\*k\*(L-L0)², with k=E\*A0/E0. The resisting force is the derivative of Wint with respect to the displacements.

As the geometric behaviour is non-linear, the tangent stiffness matrix is the sum of the material tangent stiffness (same as the one calculated for a linear geometric behaviour) and the geometric tangent stiffness.

**Part B: Displacements linear geometric behaviour and non-linear geometric behaviour**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Load | Displacements [mm] | | | |
| Linear Geometric Behaviour | | Non linear geometric behaviour | |
| U1 | U2 | U1 | U2 |
| 107 kN | 0.326 | 19.71 |  |  |
| 108 kN | 3.255 | 192.13 |  |  |
| 109 kN | 32.55 | 1971.3 |  |  |

For load 107 kN:

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**Add graphs**

**Part C: Comparison between linear geometric behaviour and non-linear geometric behaviour**

What is the percentage difference between largest displacements? What is the influence of the geometric nonlinearity on the displacement magnitude? Would you trust the results for the 3rd load case