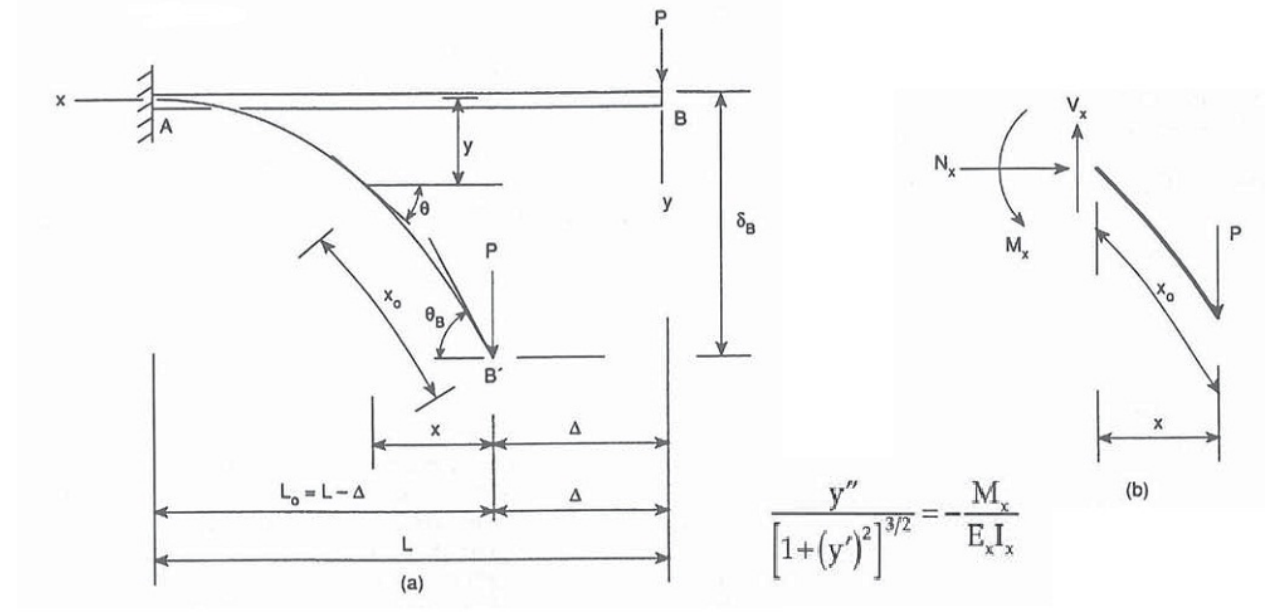
>> IN THE NAME OF GOD <<

Large Deformation Analysis Of Cantilever Beam Subjected to Concentrated Constant Vertical Load In ABAQUS and MATLAB

This Example Is Gotten From Nonlinear Structural Engineering - Demeter G.Fertis – Springer – 2006 Example: 1.1 - Page 20
This program is written by Salar Delavar Ghashghaei
Date Of Publication: 2015.05.26
E-mail: salar.d.ghashghaei@gmail.com



$$\frac{y''}{\left[1+(y')^2\right]^{3/2}} = -\frac{M_x}{E_x I_x}$$

Fig. 1.1. (a) Large deformation of a cantilever beam of uniform cross section.
(b) Free-body diagram of a beam element (Demeter G. Fertis. 2006)

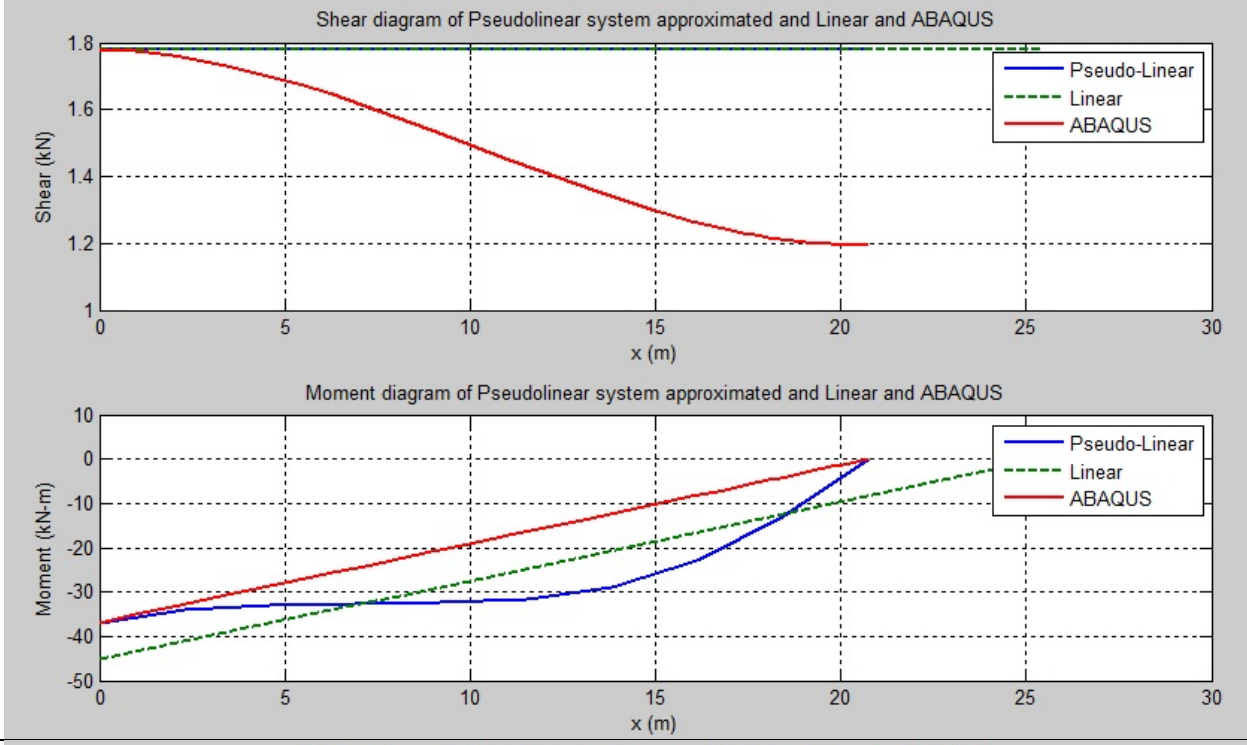
Analysis Properties:

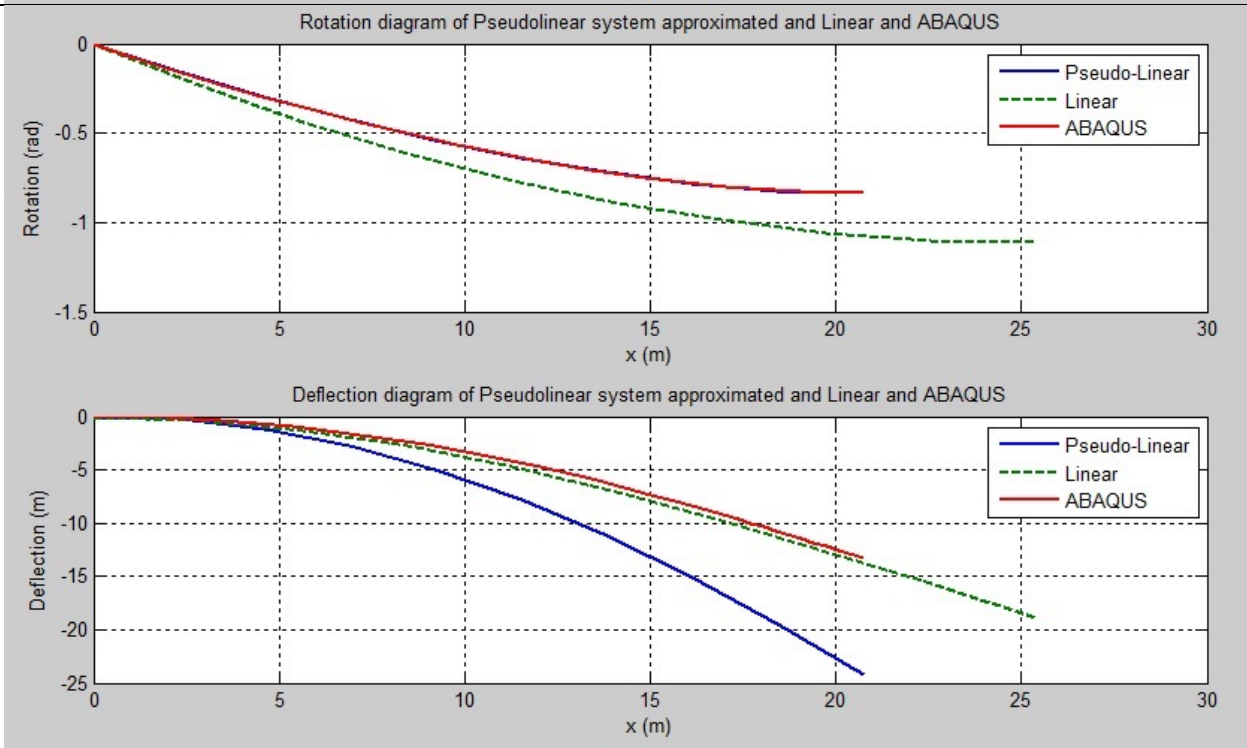
```
P=1780;% [N] Vertical Load
L=25.4;% [m] Length of Beam
EI=516540;% [N.m^2] Flextural Rigidity Of Beam
```

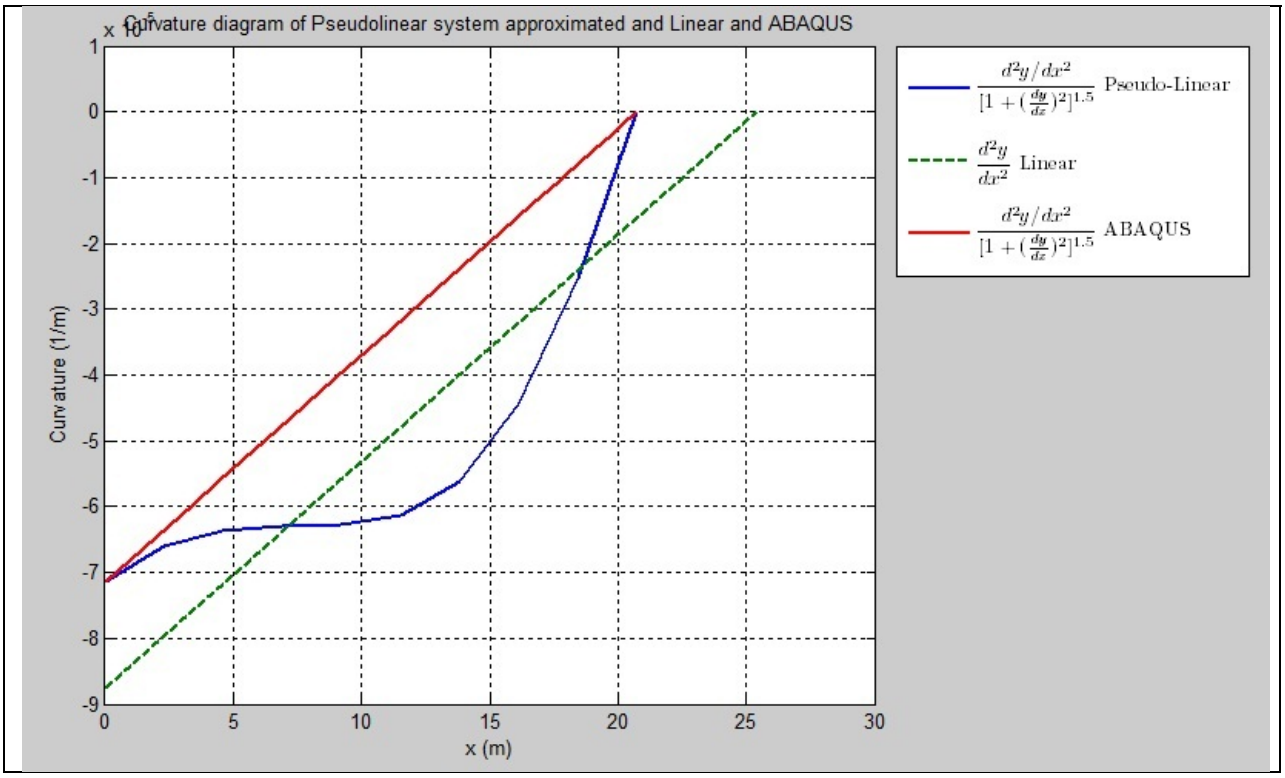
```
--------------------------------------------------------------------------------
 It is converged in 46538 iterations by Delta_x  (m) : 4.6537
 Abaqus is converged by Delta_x  (m): 4.6507
--------------------------------------------------------------------------------
************************** Result **************************
============================================================
   x     Shear(x)     Moment(x)     Teta(x)     Delta(x)
======================= Pseudo-Linear ======================
      0   1.7800  -36.9284       0       0
   2.3051   1.7800  -34.0552   -0.1563   -0.2081
   4.6103   1.7800  -32.8609   -0.2973   -1.1337
   6.9154   1.7800  -32.5424   -0.4246   -2.7346
   9.2206   1.7800  -32.4169   -0.5383   -4.9687
  11.5257   1.7800  -31.6216   -0.6374   -7.7938
  13.8309   1.7800  -28.9492   -0.7197  -11.1675
  16.1360   1.7800  -23.0028   -0.7824  -15.0478
  18.4412   1.7800  -13.0017   -0.8219  -19.3924
  20.7463   1.7800         0   -0.8354  -24.1591
============================================================
   x     Shear(x)     Moment(x)     Teta(x)     Delta(x)
========================= linear ===========================
      0   1.7800  -45.2120       0       0
   2.8222   1.7800  -40.1884   -0.2333   -0.3357
```

```
   5.6444   1.7800  -35.1649   -0.4392   -1.2910
   8.4667   1.7800  -30.1413   -0.6176   -2.7886
  11.2889   1.7800  -25.1178   -0.7685   -4.7510
  14.1111   1.7800  -20.0942   -0.8920   -7.1007
  16.9333   1.7800  -15.0707   -0.9881   -9.7602
  19.7556   1.7800  -10.0471   -1.0567  -12.6522
  22.5778   1.7800   -5.0236   -1.0979  -15.6990
  25.4000   1.7800         0   -1.1116  -18.8233
============================================================
    x     Shear(x)     Moment(x)     Teta(x)     Delta(x)
========================== ABAQUS ==========================
       0   1.7781  -36.9106   -0.0000   -0.0000
   0.9952   1.7738  -35.1405   -0.0695   -0.0348
   1.9857   1.7618  -33.3787   -0.1355   -0.1370
   3.4541   1.7320  -30.7667   -0.2283   -0.4081
   4.4171   1.7059  -29.0540   -0.2860   -0.6617
   5.3645   1.6762  -27.3692   -0.3404   -0.9687
   6.2944   1.6436  -25.7155   -0.3915   -1.3254
   7.2055   1.6092  -24.0953   -0.4396   -1.7277
   8.9677   1.5376  -20.9606   -0.5264   -2.6544
   9.8188   1.5018  -19.4469   -0.5654   -3.1717
  11.0581   1.4493  -17.2427   -0.6184   -4.0058
  11.8602   1.4158  -15.8160   -0.6503   -4.5963
  13.4101   1.3541  -13.0584   -0.7059   -5.8472
  14.8951   1.3008  -10.4157   -0.7512   -7.1747
  15.9726   1.2673   -8.4981   -0.7785   -8.2097
  16.6763   1.2483   -7.2456   -0.7937   -8.9147
  17.3701   1.2320   -6.0107   -0.8065   -9.6294
  17.7138   1.2249   -5.3990   -0.8120   -9.9899
  18.0555   1.2186   -4.7907   -0.8169  -10.3521
  18.3957   1.2130   -4.1853   -0.8212  -10.7160
  19.0717   1.2039   -2.9820   -0.8281  -11.4475
  19.4080   1.2006   -2.3833   -0.8307  -11.8149
  19.7435   1.1979   -1.7862   -0.8327  -12.1830
  20.0784   1.1960   -1.1902   -0.8341  -12.5516
  20.7469   1.1945    0.0000   -0.8353  -13.2900
============================================================
************************************************************
```

Plot:


Shear diagram of Pseudolinear system approximated and Linear and ABAQUS
Shear (kN)
x (m)
Pseudo-Linear
Linear
ABAQUS
Moment diagram of Pseudolinear system approximated and Linear and ABAQUS
Moment (kN-m)
x (m)
Pseudo-Linear
Linear
ABAQUS


Rotation diagram of Pseudolinear system approximated and Linear and ABAQUS
Rotation (rad)
x (m)
Pseudo-Linear
Linear
ABAQUS
Deflection diagram of Pseudolinear system approximated and Linear and ABAQUS
Deflection (m)
x (m)
Pseudo-Linear
Linear
ABAQUS


Curvature diagram of Pseudolinear system approximated and Linear and ABAQUS
x 10^-5
Curvature (1/m)
x (m)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
$\frac{d^2y/dx^2}{[1+(\frac{dy}{dx})^2]^{1.5}}$ Pseudo-Linear
$\frac{d^2y}{dx^2}$ Linear
$\frac{d^2y/dx^2}{[1+(\frac{dy}{dx})^2]^{1.5}}$ ABAQUS