NDAS2D 算例 ztx2

朱伯龙、屠成松、许哲明《工程结构抗震设计原理》[1`]中例题，如右图所示。单元为梁柱单元和梁单元。zxt2 的输入数据文件 data.n2d 如下：

```
zxt2   p.65,p.137-138
8,2
COOR
1,0,0,0
2,7.5,0,0
3,0,5,0
4,7.5,5,0
5,0,10,0
6,7.5,10,0
7,0,15,0
8,7.5,15,0
0/
0/
NQDP
1,333,1
3,111,1
8,111,0
0/
SORT
0
MASS
7,8,1,1.5,1.5,0
3,6,1,2.5,2.5,0
0/
ELEM
2
1,2600000,0,0.2,0.0041667,4,4,2,0,0
0/
0/
1,1,15,-15,0,0,0,0,0,0
0/
0/
1,1,3,0,1,0,1,1,0,1,0,0
2,3,5,0,1,0,1,1,0,1,0,0
3,5,7,0,1,0,1,1,0,1,0,0
4,2,4,0,1,0,1,1,0,1,0,0
5,4,6,0,1,0,1,1,0,1,0,0
6,6,8,0,1,0,1,1,0,1,0,0
0/
5
1,2600000,0,0.2,0.0041667,4,4,2,0,0
2,2600000,0,0.1875,0.0087891,4,4,2,
0,0
3,2600000,0,0.175,0.0071458,4,4,2,0,0
0/
0/
1,1,15,-15,0,0,0,0,0,0
2,1,15,-15,0,0,0,0,0,0
3,1,22.5,22.5,0,0,0,0,0,0
0/
0/
1,3,4,0,2,0,2,2,0,1,0,0
2,5,6,0,2,0,3,3,0,1,0,0
3,7,8,0,3,0,3,3,0,1,0,0
0/
MAXX
```

图 1　NDAS2D 显示结构及构件布置

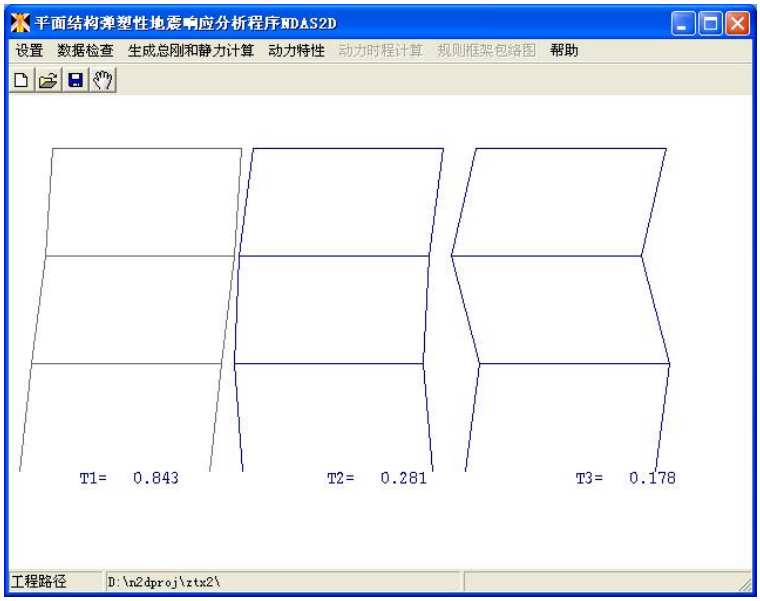

图 2　NDAS2D 显示的振形图

```
10
DPRX
7,7,1
0/
GPRT
7,7,1
0/
SKSV
DAMP
0.64,0,0
EIGE
3,0.00001
DATD
0.5,0.16667,1.4,0.02
EQRA
1,500,-500,0.02,0.01,0,0
EQAX   tianjin record 1976,8,31(Time int. =0.02 s.)
 1.9,   5.7,   8.5,   2.8,  -2.8,  -3.9,  -2.5
  -4.2,  -7.9,  -5.7,   -.3,   3.1,   1.9,   1.9,   6.7
  11.4,  17.7,  24.8,  31.4,  35.1,  38.8,  43.1,  47.5
  50.9,  53.3,  56.9,  60.5,  64.1,  67.7,  67.7,  65.0
  64.1,  51.8,  22.3,  -6.6,-28.8,-51.0,-65.8,-75.7
 -85.7,-89.6,-88.5,-92.0,-91.6,-98.6,-105.7,-112.8
-112.2,-107.3,-102.3,-97.3,-93.6,-92.0,-80.6,-65.0
 -49.5,-35.4,-25.1,-14.7,  -4.1,   5.2,  11.3,  17.8
  22.8,  29.5,  47.1,  64.7,  77.0,  84.0,  90.6,  94.3
  99.433,104.622,103.832,  94.583,  77.437,  59.897,  42.018,  27.467,   20.586,  11.506
   1.692,   4.004,   8.968,  12.408,   9.306,   4.286,  -3.046,-14.044,  -24.647,-34.912
 -27.128,-14.438,   3.158,  22.109,  29.328,  26.959,  30.456,  36.322,   31.471,  13.649
 -16.300,-39.085,-26.846,  -8.404,  -4.061,  -6.373,   -.620,   4.850,   11.280,  13.931
  11.562,   9.193,   6.317,  -2.030,-22.109,-44.782,-34.009,-10.547
   1.748,   2.030,   8.178,  19.909,  30.174,  27.185,  25.888,  24.365
  22.222,  18.217,   3.666,-13.141,-33.389,-40.777,-48.391,-49.801
 -47.038,-51.211,-57.697,-62.378,-56.005,-48.955,-46.530,-39.424
 -25.042,   3.271,  24.365,  39.649,  58.938,  79.637,  93.173,106.652
 106.934,103.832,  81.836,  58.036,  35.927,  13.423,-14.664,-35.024
 -46.981,-58.769,-46.981,-28.087,  -4.625,   1.297,  -3.553,  -3.610
  -9.814,  -4.456,  11.788,  33.840,  49.632,  47.376,  26.677,   9.701
  -2.989,-15.792,-26.000,-20.924,-18.330,-24.026,-26.621,-19.571
 -10.772,   -.338,  -3.779,  -8.178,  -8.065,  -2.425,  11.393,  21.150
  20.812,  11.054,  -1.974,-15.792,-15.172,  -8.911,   7.727,  21.940
  26.564,  26.170,  21.714,  17.315,  14.890,  13.762,  10.208,  10.885
  20.642,  37.168,  36.660,  24.985,  13.762,  10.547,   8.234,  -2.989
  -4.004,  -5.076,  -6.091,  -4.286,  -1.974,   1.128,  -4.568,-12.634
 -18.104,-13.649,  -6.768,   -.902,   4.174,   9.250,  12.521,  11.167
   6.712,  16.751,  27.467,  38.690,  36.378,  20.586,   5.922,   3.046
    .056,-13.254,-26.790,-40.100,-44.161,-39.706,-31.528,-23.293
 -18.443,-17.992,-16.130,-14.551,-15.961,-21.883,-27.805,-27.354
 -30.456,-33.558,-31.697,-22.278,-12.859,  -6.824,  -2.876,  -2.764
  -8.234,-13.705,-19.176,-18.612,-17.992,-17.371,-15.397,-10.603
  -5.640,   -.451,   9.024,  18.499,  27.974,  32.825,  28.933,  25.154
  26.564,  23.293,  16.243,   9.137,   2.087,  -3.215,  -7.501,    .733
   9.024,  17.315,  25.324,  29.328,  30.174,  27.241,  21.940,  15.002
   8.065,   1.466,  -4.343,  -6.994,  -8.573,-10.152,-11.506,-12.859
 -11.054,  -8.460,  -6.486,  -7.050,  -7.727,  -8.404,  -8.629,  -6.260
  -6.260,  -6.712,  -7.219,  -1.015,   5.414,  11.788,  15.284,  14.326
   6.373,  -1.523,  -9.024,-14.269,-19.571,-24.703,-29.441,-27.749
 -19.402,  -8.122,   1.297,   3.722,   4.456,   2.482,    .508,  -1.410
   -.113,   3.779,   7.670,   7.050,   5.302,   3.553,   3.553,   4.174
   9.080,  15.059,  18.499,  17.935,  13.818,   5.696,  -1.805,    .451
```

```
   2.876,   3.553,   2.030,   4.512,   8.009,   8.573,   7.614,  -1.636
 -12.464, -21.658, -28.538, -35.363, -34.686, -31.358, -28.031, -24.703
 -21.432, -11.675,  -5.640,  -5.414,  -9.024, -12.690, -15.115, -15.623
 -14.890, -14.156, -13.085,  -9.193,  -6.091,  -6.768,  -7.219,  -5.132
   1.015,   8.178,  13.480,  15.736,  12.464,   8.516,   3.892,   5.922
   8.009,   8.573,   4.681,   1.692,   2.030,   2.425,   1.184,  -2.200
 -12.182, -18.048, -17.653, -12.577,  -7.501,  -3.046,  -2.256,  -4.512
   -.508,   3.779,   7.896,   7.332,   6.768,   6.260,   5.414,   2.425
   -.338,    .282,   2.933,   5.527,   5.471,   3.271,  -5.245, -12.239
 -17.653, -21.714, -18.838, -15.905, -11.449,  -6.937,  -2.764,    .677
   2.425,   2.538,   2.651,   2.707,   2.820,   1.805,   -.790,  -3.384
  -6.035,  -7.445,  -5.809,  -1.805,   1.636,   5.132,   8.291,   9.193
   7.106,   5.076,   3.158,   4.512,   6.599,   8.686,   9.250,   8.573
   8.968,  10.885,  12.746,  12.803,  12.859,   8.291,   2.200,  -3.892
 -10.039, -12.972, -15.792, -18.556, -21.037, -23.519, -21.714, -16.920
 -12.182,  -8.009,  -5.020,  -9.193, -13.310, -16.807, -16.638, -16.920
 -19.120, -21.319, -18.725, -14.100,  -9.362,  -2.369,   7.332,  10.716
  11.336,  14.495,  21.376,  28.256,  32.656,  31.076,  26.677,  15.679
   5.584,   3.666,   1.748,    .902,   2.030,   3.158,   2.482,  -1.297
  -7.219,  -9.814, -15.059, -15.059, -15.792, -15.059, -14.326,  -9.250
LOAD
1,1
2
2,3,3,1,-1,-1
0/
1
PENV
100
PLOT
7,1,1
0/
```

文献[1]自振周期手工计算结果：T1=0.836，T2=0.279，T3=0.178。NDAS2D 结果及振型显示见图 2。文献[1]时程响应计算结果见图 3，其中 m_3 是框架顶部质量。图 4 是 NDAS2D 框架顶部计算结果（单位是 m），可见其与文献[1]结果图 3 位移响应最大值及变形趋势较为一致。

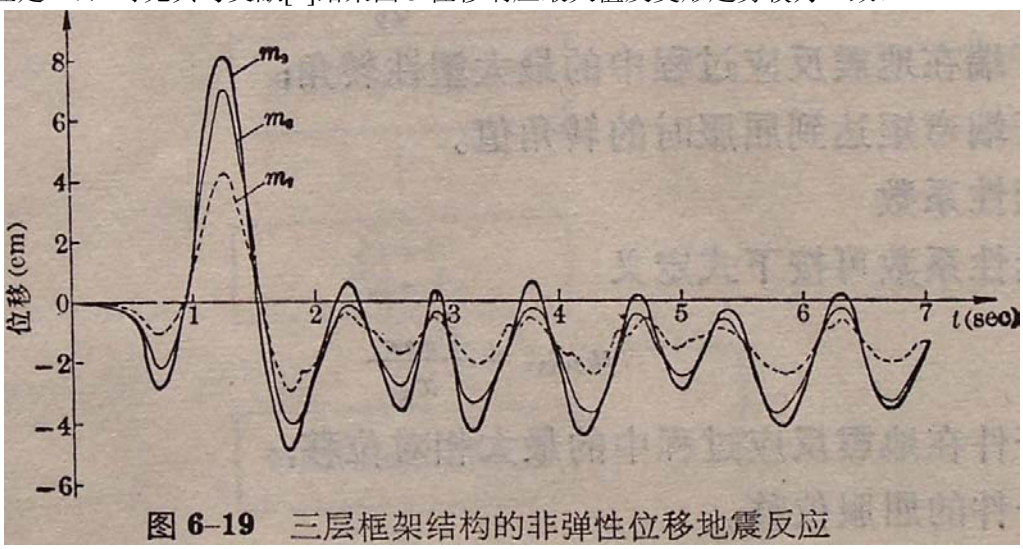

图 3　文献[1]时程响应计算结果

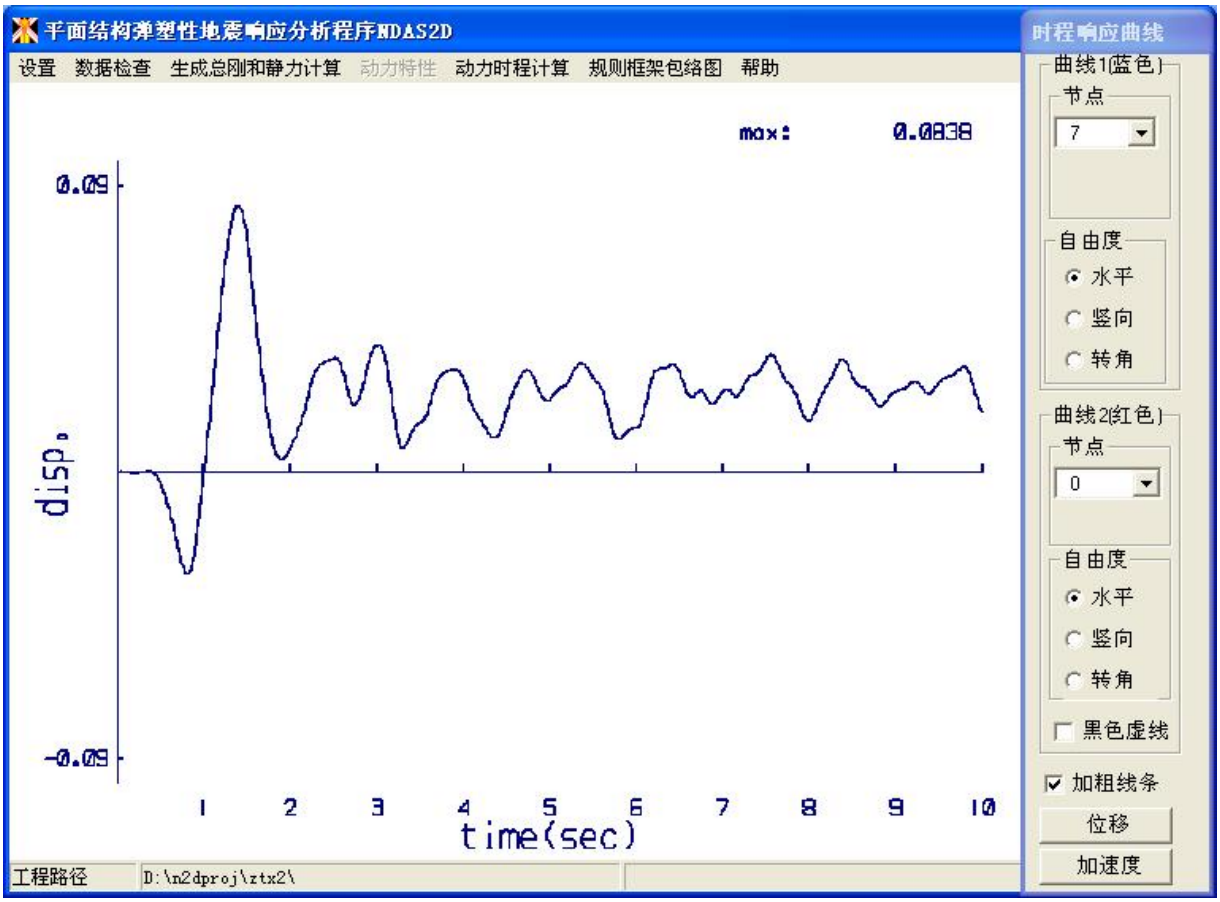

图 3　NDAS2D 显示的 zxt2 结构 7 节点水平位移响应曲线

参考文献

[1] 朱伯龙、屠成松、许哲明：《工程结构抗震设计原理》，上海科学技术出版社，1982 年 5 月。