

## #1335: OptiStruct – Nonlinear Direct Transient Analysis

**Product:** OptiStruct

**Product Version:** OptiStruct 14.0.210 or above

### Topic Objective

Nonlinear Direct Transient Analysis in OptiStruct.

### Topic Detail

This solution sequence performs Large Displacement Nonlinear Direct Transient Analysis.

The predominant difference between Nonlinear Quasi-Static Analysis and Nonlinear Transient Analysis is the inclusion of Inertia and Momentum terms in the solution of the Energy equation.

This nonlinear transient solution sequence typically supports all nonlinear features supported by NLSTAT (LGDISP), including Geometric Large Displacement Nonlinearity, Material Nonlinearity, and Contact. Subcase continuation between nonlinear transient and NLSTAT is also supported.

### How to setup in OptiStruct

1. Parameters for NL transient analysis solution control can be defined using TSTEPNL/ NLPARM bulk data card
2. Using both TSTEPNL and NLPARM in a subcase is not supported
3. When TSTEPNL is present in NL transient analysis, OS runs with generalized alpha method
  - a. Automatic time stepping is not supported
  - b. Supported for Nastran compatibility
  - c. Not recommended
4. When NLPARM is present in nonlinear transient analysis, TSTEP entry is mandatory
  - a. Time stepping schemes, automatic time stepping can be defined using TSTEP bulk data card
  - b. DT on NLPARM overrides DT on TSTEP
  - c. DT and TTERM on NLPARM, if specified together, override the value defined on the NINC field
  - d. If DT on NLPARM is not specified, the default initial load increment is equal to TTERM/NINC
    - i. If DT and NDT are defined on TSTEP card and no TTERM is defined on NLPARM, then  $TTERM = DT * NDT$
    - ii. If TTERM on NLPARM is defined, it overwrites TTERM calculated from DT and NDT on TSTEP
  - e. If DT, TTERM, and NINC on NLPARM and DT and NDT on TSTEP are not specified, the default initial load increment is equal to 1

### Example: Three Point Bending

```

SUBCASE      1
  LABEL NLTRAN
ANALYSIS
  SPC =      3
  DLOAD = 100
  NLPARM =   9
  TSTEP = 1
  NLOUT= 20
    
```

```

TSTEP      1      100      0.1
           1
$$$
$$$
$$$ NLPARM cards
$$$
$HNAME LOADCOL           5"LC_NLPARM"
$HWCOLOR LOADCOL         5      6
$$$
NLPARM      9      500      0.12      80      UP
+      1.00E-2  1.0E-10
                20.0
    
```

3.0e-5  
Raleigh damping, alpha

Number of time steps, time increments

