

# Workshop - Working with Multiple Subcases and Multi Discipline Optimization

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AN MSC NASTRAN SOL 200 TUTORIAL

# Optimization Problem Statement

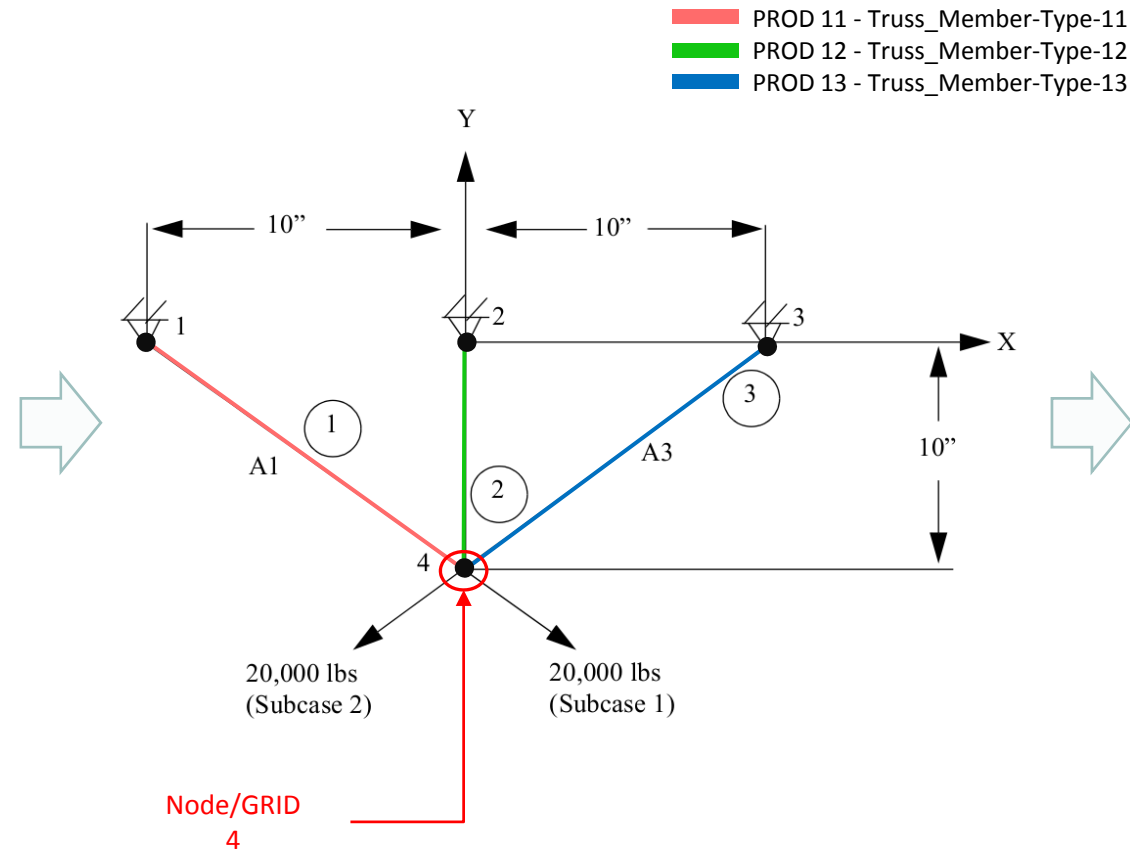
## Design Variables

x1: A of PROD 11  
x2: A of PROD 12  
x3: A of PROD 13

$$.1 < x1, x2, x3 < 100.$$

Variable Link

$$x3 = x1$$



## Design Objective

r0: Minimize weight

## Design Constraints

r1: Axial stress of elements related to  
PROD 11, 12, 13

$$-15000 < r1 < 20000$$

r2: x and y component of displacement for  
node 4

























$$-.2 < r2 < .2$$

r3: natural frequency of mode 1  
80 Hz < r3

# Optimization Problem Statement

## Subcase Assignment

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	Status ▾	Label ▾	Response Type ▾	Analysis Type ▾	Description	Global Constraints ▾	SUBCASE 1 ▾	SUBCASE 2 ▾	SUBCASE 3 ▾	SUBCASE 4 ▾	SUBCASE 5 ▾	SUBCASE 6 ▾	SUBCASE 7 ▾	SUBCASE 8 ▾	SUBCASE 9 ▾	SUBCASE 10 ▾
		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>											
						Analysis Types →	Normal Modes ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾	Statics ▾
		r1	DISP	STATICS	T1, T2 component(s) of displacement at grid 4											
		r2	STRESS	STATICS	Stress, Axial stress, of elements associated with PROD 11, 12, 13											
		r3	FREQ	MODES	Natural frequency of mode 1											

# Contact me

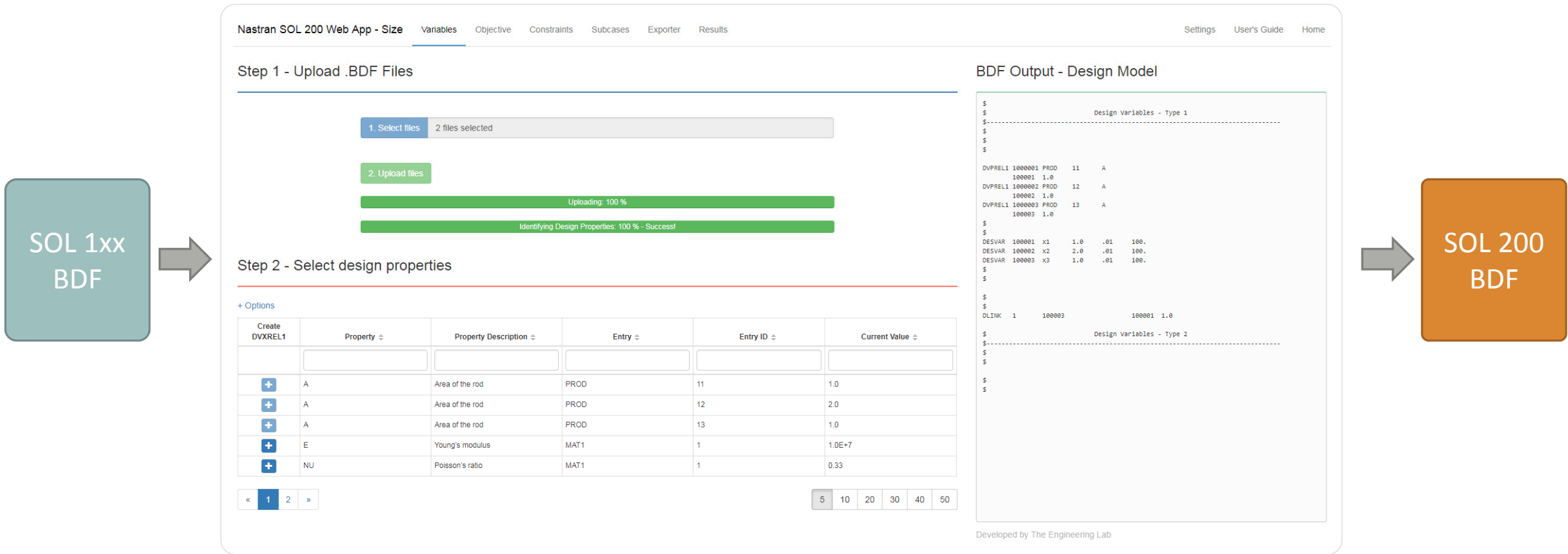
- Nastran SOL 200 training
- Nastran SOL 200 questions
- Structural optimization questions
- Access to the MSC Nastran SOL 200 Web App

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# Tutorial

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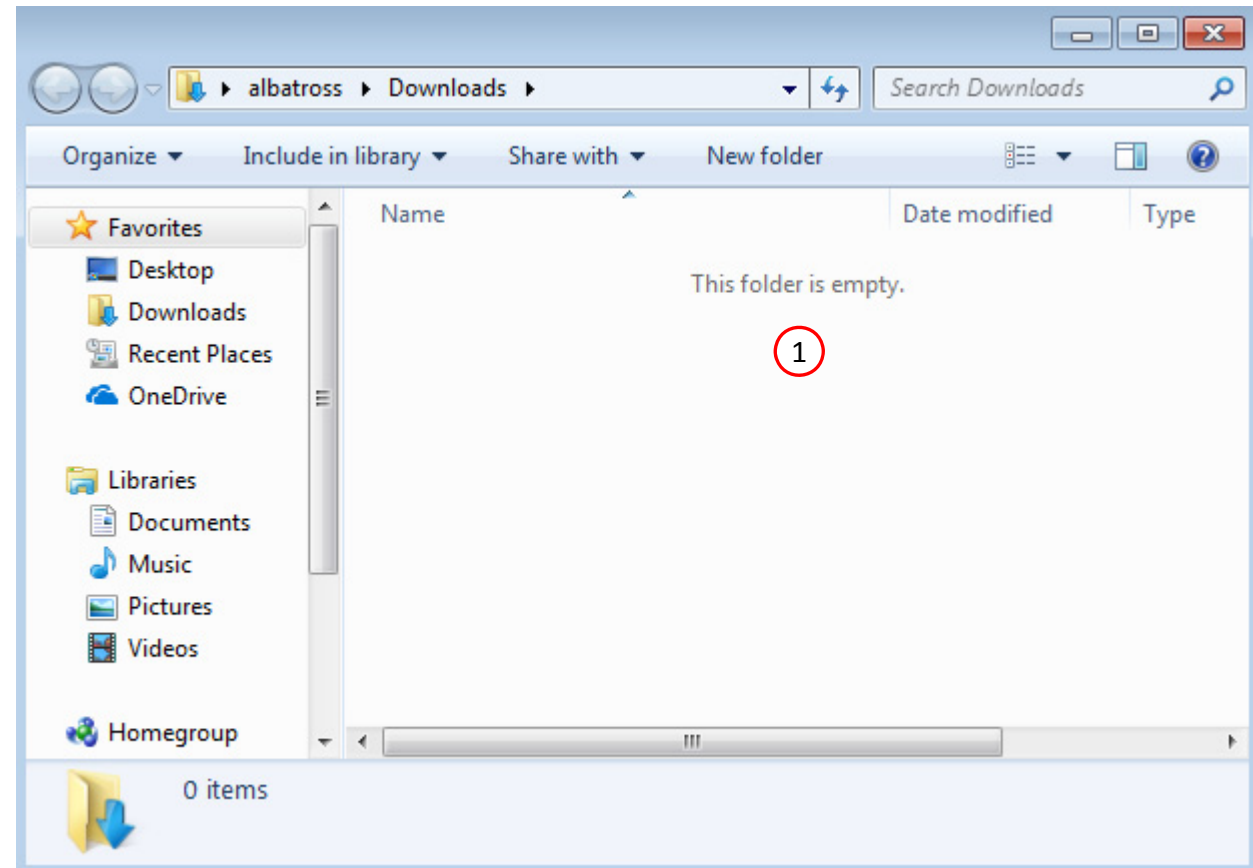
# MSC Nastran SOL 200 Web App



# Before Starting

1. Ensure the Downloads directory is empty in order to prevent confusion with other files

- Throughout this workshop, you will be working with multiple file types and directories such as:
  - .bdf/.dat
  - nastran\_working\_directory
  - .f06, .log, .pch, .h5, etc.
- To minimize confusion with files and folders, it is encouraged to start with a clean directory.



# Go to the User's Guide

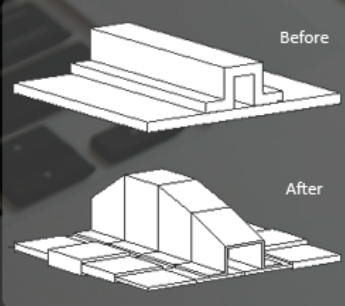
1. Click on the indicated link

- The necessary BDF files for this tutorial are available in the Tutorials section of the User's Guide.

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## MSC Nastran SOL 200 Web App

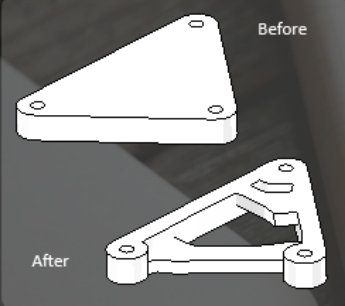
Select a web app to begin



Before

After

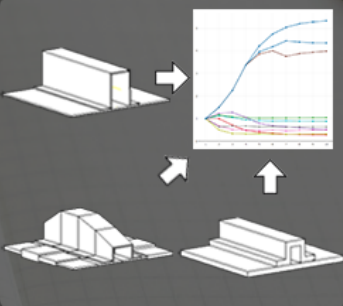
Size and Topometry



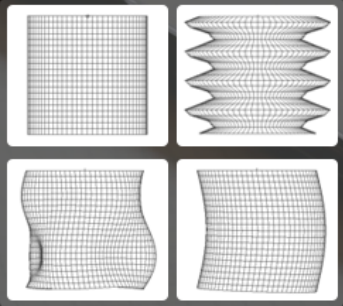
Before

After

Topology



Multi Model



Parameter Study

1 Tutorials are available in the User's Guide

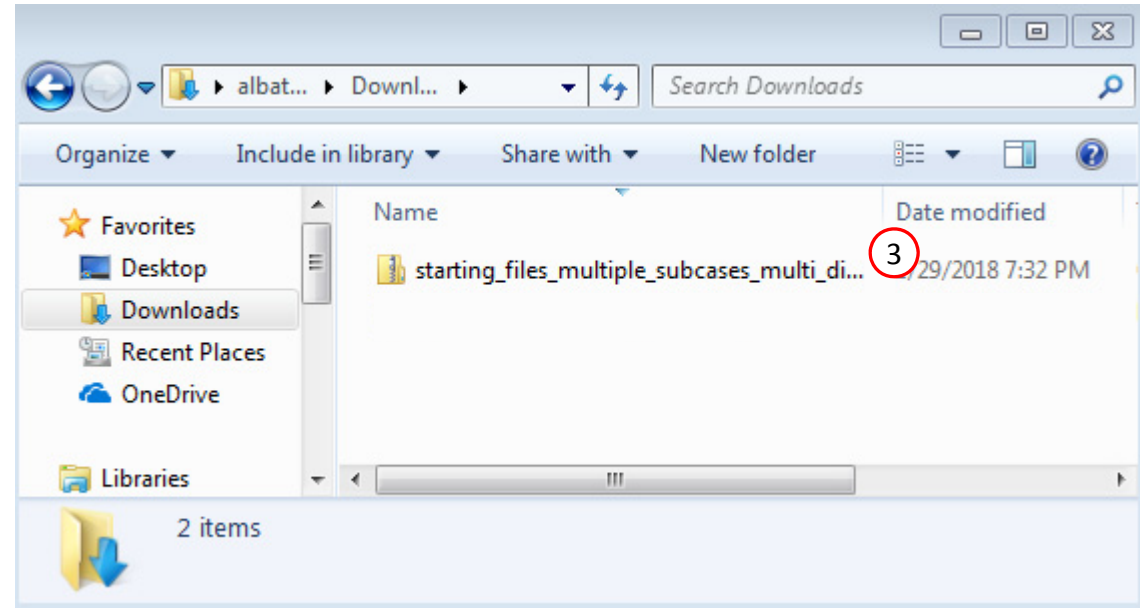


# Obtain Starting Files

1. Find the indicated example
2. Click Link
3. The starting file has been downloaded

- When starting the procedure, all the necessary BDF files must be collected together.

	<p><b>1 Optimization for Multiple Load Cases or SUBCASES</b></p> <p>The web app makes simple configuring design constraints for dozens or hundreds of load cases. This tutorial guides you through the process.</p> <p>Starting BDF Files: <a href="#">Link</a></p> <p>Solution BDF Files: <a href="#">Link</a></p>	
	<p><b>Global Optimization</b></p>	



# Open the Correct Page

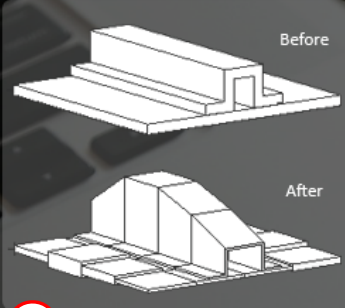
1. Click on the indicated link

- MSC Nastran can perform many optimization types. The MSC Nastran SOL 200 Web App includes dedicated web apps for the following:
  - Size and Topometry Optimization
  - Topology Optimization
  - Global Optimization
  - Multi Model Optimization
- The web app also features the HDF5 Explorer, a web application to extract results from the H5 file type.

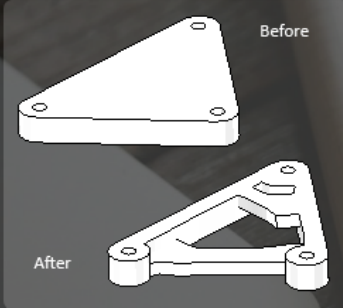
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## MSC Nastran SOL 200 Web App

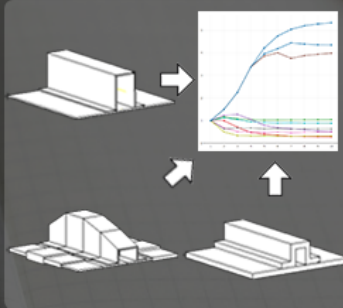
Select a web app to begin



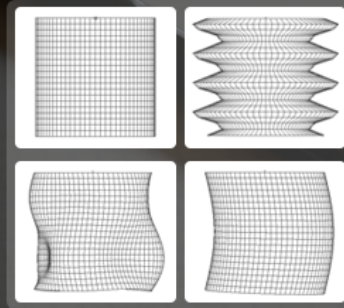
1 Size and Topometry



Topology



Multi Model



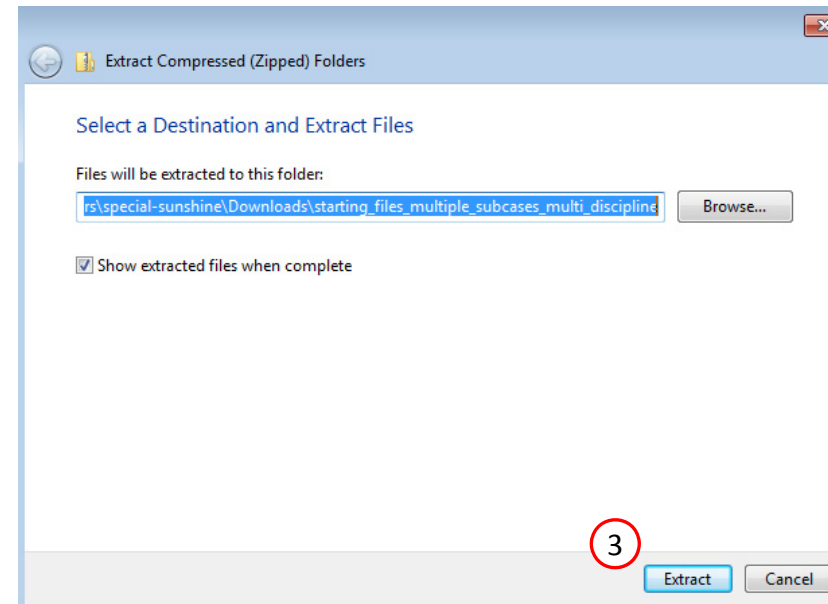
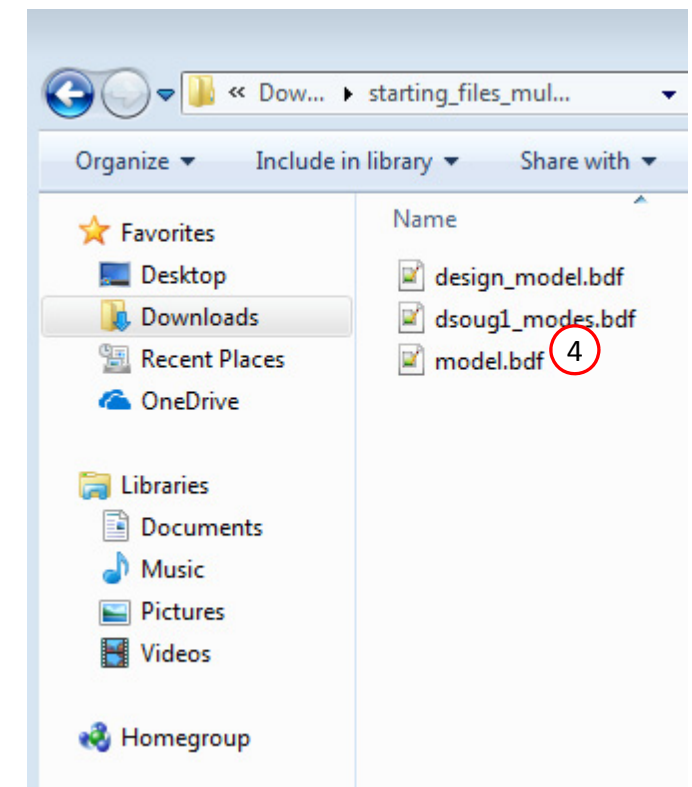
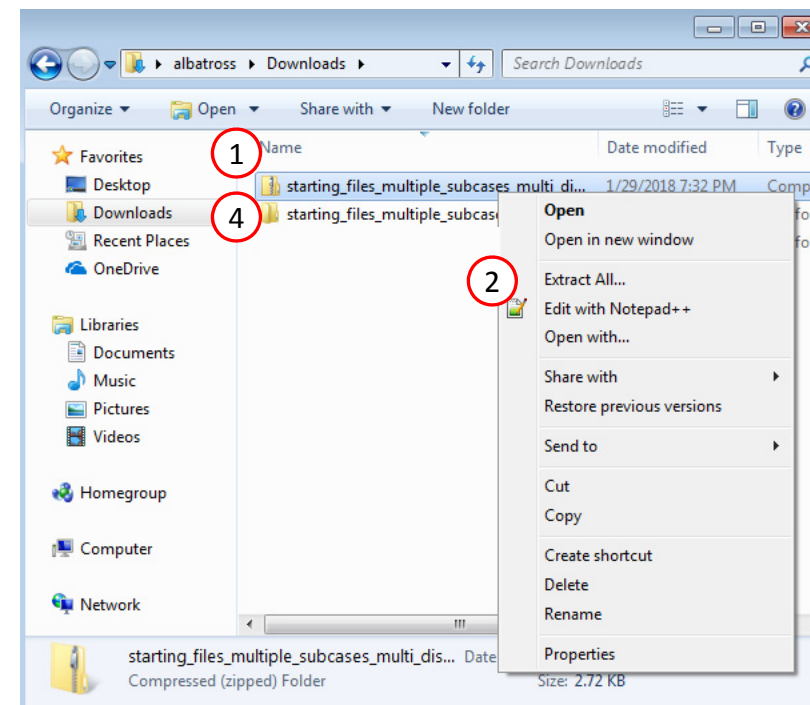
Parameter Study

Tutorials are available in the User's Guide

# Obtain Starting Files

1. Right click on the zip file
2. Select Extract All...
3. Click Extract
4. The starting files are now available in a folder

- This example is using a previously created design model. The design model is a model that has been converted to SOL 200 and contains bulk data entries describing the optimization problem statement, e.g. variables, objective and constraints.



# Merge the BDF files

Two sets of bulk data files (BDF) have been provided.

- Set 1: model.bdf and design\_model.bdf
- Set 2: dsoug1\_modes.bdf

The Set 1 files are configured to perform only a static analysis optimization and contains 19 load cases. The Set 2 file is the same Finite Element Model, but configured to perform an eigenvalue or normal modes analysis. The procedure below merges information from Set 2 to Set 1. Afterwards, the files of Set 1 can be modified to perform both a static and normal modes analysis for 20 subcases.

1. Open *dsoug1\_modes.bdf*. Take SUBCASE 1 and move it to *model.bdf*.
2. Take the line with EIGRL at the beginning and move it to *model.bdf*
3. Save *model.bdf*

- There are 2 methods to perform multidisciplinary optimization:
  - Method 1 - Merge the necessary bulk data files and use ANALYSIS in each SUBCASE, e.g. ANALYSIS=STATICS, ANALYSIS=MODES. This method is used for this tutorial.
  - Method 2 – Use the Multi Model Optimization capability. This does not require that manual merging of files as shown on this page.

```
1 assign userfile = 'optimization_results.csv', status = new,
2 form = formatted, unit = 52
3 $ 1 2 3 4 5 6 7 8 9 10
4 ID MSC DSOU1 $ v2004 ehj 25-Jun-2003
5 TIME 10 $
6 SOL 200
7 CEND
8
9
10 TITLE = SYMMETRIC THREE BAR TRUSS DESIGN OPTIMIZATION - DSOU1
11 SUBTITLE = BASELINE - 2 CROSS SECTIONAL AREAS AS DESIGN VARIABLES
12 $ Result Output
13 ECHO = SORT
14 SPC = 100
15 DISPLACEMENT(SORT1,REAL)=ALL
16 SPCFORCES(SORT1,REAL)=ALL
17 STRESS(SORT1,REAL,VONMISES,BILIN)=ALL
18 $ Subcases
19 $ DSAPRT(FORMATTED, EXPORT, END=SENS) = ALL
20 ANALYSIS = STATICS
21 DESOBJ(MIN) = 8000000
22 DESSUB = 40000004
23 $ DESSUB Slot
24 SUBCASE 1
25 SUBTITLE=Modes Analysis
26 METHOD = 1
27 SPC = 100
28 VECTOR(SORT1,REAL)=ALL
29 SPCFORCES(SORT1,REAL)=ALL
30 SUBCASE 2
31 $ DESSUB Slot
32 $ ANALYSIS Slot
33 $ DRSPAN Slot
34 SUBTITLE=Static Analysis 1
35
36 BEGIN BULK
37 INCLUDE './design_model.bdf'
38 param, post, 0
39 PARAM PRTMAXIM YES
40 EIGRL 1 3 0 MASS
41 $
42 $-----
43 $ ANALYSIS MODEL
44 $
45 $ GRID DATA
46 $ 2 3 4 5 6 7 8 9 10
47 GRID 1 3 -10.0 0.0 0.0
48 GRID 2 0.0 0.0 0.0
49 GRID 3 10.0 0.0 0.0
50 GRID 4 0.0 -10.0 0.0
51 $ SUPPORT DATA
52 SPC1 100 123456 1 THRU 3
53 $ ELEMENT DATA
54 CROD 1 11 1 4
55 CROD 2 12 2 4
56 CROD 3 13 3 4
57 $ PROPERTY DATA
58 PROD 11 1 1.0
59 PROD 12 1 2.0
60 PROD 13 1 1.0
61 MAT1 1 1.0E+7 0.33 0.1
62 $ EXTERNAL LOADS DATA
63 FORCE 300 4 20000. 0.8 -0.6
64 FORCE 310 4 20000. -0.8 -0.6
65 ENDDATA
```

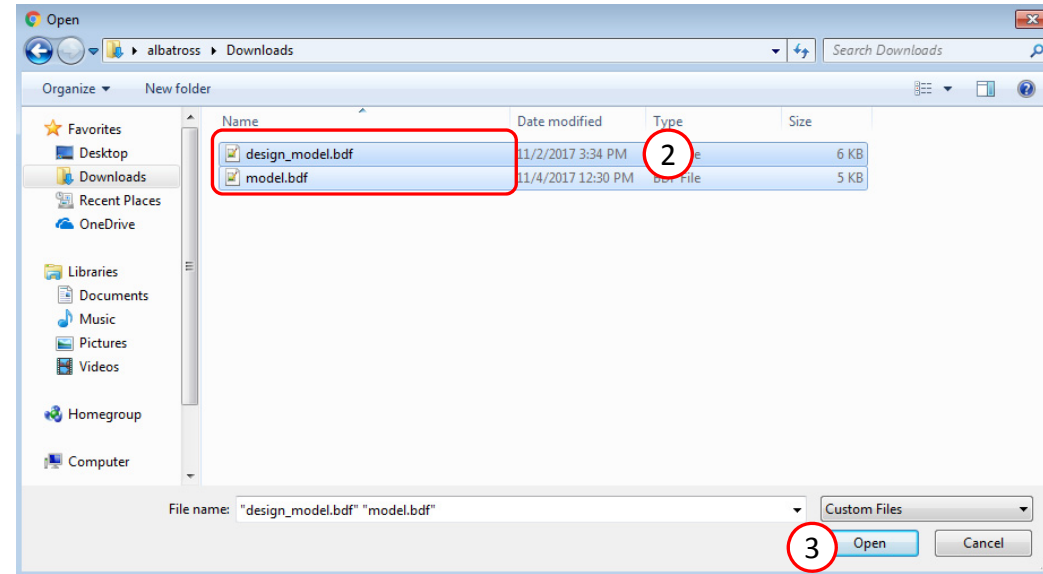
```
1 $ MSC.Nastran input file created on November 02, 2017 at 15:0
2 $ Patran 2017.0.2
3 $ Direct Text Input for Nastran System Cell Section
4 $ Direct Text Input for File Management Section
5 $ Direct Text Input for Executive Control
6 $ Normal Modes Analysis, Database
7 SOL 103
8 CEND
9 $ Direct Text Input for Global Case Control Data
10 TITLE = SYMMETRIC THREE BAR TRUSS DESIGN OPTIMIZATION -
11 ECHO = NONE
12 $ DSAPRT(FORMATTED, EXPORT, END=SENS) = ALL
13 SUBCASE 1
14 SUBTITLE=Modes Analysis
15 METHOD = 1
16 SPC = 100
17 VECTOR(SORT1,REAL)=ALL
18 SPCFORCES(SORT1,REAL)=ALL
19 $ Direct Text Input for this Subcase
20 BEGIN BULK
21 $ Direct Text Input for Bulk Data
22 PARAM POST 0
23 PARAM PRTMAXIM YES
24 EIGRL 1 3 0
25 $ Elements and Element Properties for region : prod.11
26 PROD 11 1 1.
27 $ Pset: "prod.11" will be imported as: "prod.11"
28 CROD 1 11 1 4
29 $ Elements and Element Properties for region : prod.12
30 PROD 12 1 2.
31 $ Pset: "prod.12" will be imported as: "prod.12"
32 CROD 2 12 2 4
33 $ Elements and Element Properties for region : prod.13
34 PROD 13 1 1.
```

```
20 BEGIN BULK
21 $ Direct Text Input for Bulk Data
22 PARAM POST 0
23 PARAM PRTMAXIM YES
24 EIGRL 1 3 0
25 $ Elements and Element Properties for region : prod.11
26 PROD 11 1 1.
27 $ Pset: "prod.11" will be imported as: "prod.11"
28 CROD 1 11 1 4
29 $ Elements and Element Properties for region : prod.12
30 PROD 12 1 2.
31 $ Pset: "prod.12" will be imported as: "prod.12"
32 CROD 2 12 2 4
33 $ Elements and Element Properties for region : prod.13
34 PROD 13 1 1.
35 $ Pset: "prod.13" will be imported as: "prod.13"
36 CROD 3 13 3 4
37 $ Referenced Material Records
38 $ Material Record : mat1.1
39 $ Description of Material :
40 MAT1 1 1.+7 3.7594+6.33 .1
41 $ Nodes of the Entire Model
42 GRID 1 -10. 0. 0.
43 GRID 2 0. 0. 0.
44 GRID 3 10. 0. 0.
45 GRID 4 0. -10. 0.
46 $ Loads for Load Case : Default
47 SPCADD 2 100
48 $ Displacement Constraints of Load Set : spc1.100
49 SPC1 100 123456 1 2 3
50 $ Referenced Coordinate Frames
51 ENDDATA 202082fa
52
```

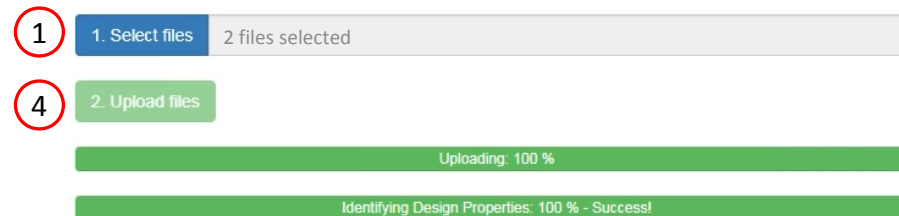
# Upload BDF Files

1. Click 1. Select Files
2. Select these two files:
  1. model.bdf
  2. design\_model.bdf
3. Click Open
4. Click Upload Files

- The process starts by uploading all the necessary BDF files. The BDF files can be files of your own or files found in the Tutorials section of the User's Guide.



## Step 1 - Upload .BDF Files



# Create Design Constraints

- 1. Click Constraints
- 2. Set the analysis type to Normal Modes
- 3. Click the plus (+) icon for Frequency
- 4. Configure the following for constraint r1
  - 1. ATTA: 1 (mode 1)
  - 2. Lower Allowed Limit: 80. (80. Hz)

• Part of the design model has already been created. The variables, objective and constraints for a statics optimization have been configured. On this page, a new constraint for the 1<sup>st</sup> natural frequency is created. The goal is to perform both a statics and modes optimization.

Nastran SOL 200 Web App - SizeVariablesObjectiveConstraintsSubcasesExporterResults

1

Step 1 - Select constraints

Select an analysis type

2SOL 103 - Normal Modes

Select a response

	Response Description ▾	Response Type ▾
+	Weight	WEIGHT
+	Volume	VOLUME
+	Eigenvalue	EIGN
3+	Frequency	FREQ
+	Displacement	DISP

«123»

51020304050

Step 2 - Adjust constraints

+ Options

	Label ▾	Status ▾	Response Type ▾	Property Type ▾	ATTA ▾	ATTB ▾	ATTi ▾	Lower Allowed Limit	Upper Allowed Limit
✕	r1	✔	DISP		12 - T1, T2 ▾		4	-.2	.2
✕	r2	✔	STRESS	PROD ▾	2 - Axial stress ▾		11, 12, 13	-15000.	20000.
✕	r3	✔	FREQ	STRUC ▾	14.1		4.2	80.	Upper



### 3. Click Jump To Table

- 15

# Assign Constraints to Load Cases (SUBCASES)

1. Click Subcases

2. Select each option in the select box (Hold down the Shift key on the keyboard and use the mouse to select multiple options)



3. Click + Options

4. Mark the checkbox for Expand Width of Table

5. Note that the r3 constraint for natural frequency has a yellow status icon, indicating that the constraint is not assigned to any subcases

6. Change the analysis type of column SUBCASE 1 to Normal Modes

7. Mark the checkbox

- A change from a yellow to blue status (  =>  ) means the constraint is assigned to at least one column
- r3 or the natural frequency constraint is applied to SUBCASE 1

Nastran SOL 200 Web App - Size Variables Objective Constraints **Subcases** Exporter Results Settings User's Guide Home

Step 1 - Assign constraints to subcases




Display Columns

SUBCASE 15  
SUBCASE 16  
SUBCASE 17  
SUBCASE 18  
SUBCASE 19  
SUBCASE 20

☐ Uncheck visible boxes ☒ Check visible boxes

+ Options

☒ Expand Width of Table ☒ Use Multidisciplinary (MD) Optimization

Status	Label	Response Type	Analysis Type	Description	Global Constraints	SUBCASE 1	SUBCASE 2	SUBCASE 3	SUBCASE 4	SUBCASE 5	SUBCASE 6	SUBCASE 7	SUBCASE 8	SUBCASE 9	SUBCASE 10	SUBCASE 11
					Analysis Types	Normal Modes	Statics	Statics	Statics	Statics	Statics	Statics	Statics	Statics	Statics	Statics
	r3	FREQ	MODES	Natural frequency of mode 1												
	r2	STRESS	STATICS	Stress, Axial stress, of elements associated with PROD 11, 12, 13			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	r1	DISP	STATICS	T1, T2 component(s) of displacement at grid 4			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



# Assign Constraints to Load Cases (SUBCASES)

1. Click 2 times the Label column to sort the Label column in descending order

## Other information

2. Descriptions of each constraint are available and can be used to confirm the constraint has been properly configured
3. The blue bar indicates at least one constraint has been applied to the column/SUBCASE
4. The horizontal scroll bar can be used to navigate across multiple SUBCASES

- When hundreds of SUBCASEs must be configured, the following options expedite the process:

Uncheck visible boxes

Check visible boxes

Nastran SOL 200 Web App - Size Variables Objective Constraints Subcases Exporter Results

Settings User's Guide Home

### Step 1 - Assign constraints to subcases

Display Columns

SUBCASE 15  
SUBCASE 16  
SUBCASE 17  
SUBCASE 18  
SUBCASE 19  
SUBCASE 20

+ Options

☒ Expand Width of 1 ☒ Use Multidisciplinary (MD) Optimization

Status	Label	Response Type	Analysis Type	Description	Global Constraints	SUBCASE 1	SUBCASE 2	SUBCASE 3	SUBCASE 4	SUBCASE 5	SUBCASE 6	SUBCASE 7	SUBCASE 8	SUBCASE 9	SUBCASE 10	SUBCASE 11
		r1	DISP	STATICS	T1, T2 component(s) of displacement at grid 4			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		r2	STRESS	STATICS	Stress, Axial stress, of elements associated with PROD 11, 12, 13			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		r3	FREQ	MODES	Natural frequency of mode 1	<input checked="" type="checkbox"/>										

Analysis Types → Normal Modes ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics ▾ Statics

5 10 20 30 40 50

Developed by The Engineering Lab

1. Click on Exporter
2. Click on Download BDF Files

1. Click on Exporter
2. Click on Download BDF Files

**Nastran SOL 200 Web App - Size**
Variables Objective Constraints Subcases **Exporter** Results
Settings User's Guide Home

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### BDF Output - Model

```

assign userfile = 'optimization_results.csv', status = new,
form = formatted, unit = s2
$_1_|$_2_|$_3_|$_4_|$_5_|$_6_|$_7_|$_8_|$_9_|$_10_|
ID MSC DSOU1 $ v2004 ehj 25-Jun-2003
TIME 10 $
SOL 200
CEID

TITLE = SYMMETRIC THREE BAR TRUSS DESIGN OPTIMIZATION - DSOU1
SUBTITLE = BASELINE - 2 CROSS SECTIONAL AREAS AS DESIGN VARIABLES
$ Result output
ECHO      = SORT
SPC       = 100
DISPLACEMENT(SORT1,REAL)=ALL
SPCFORCES(SORT1,REAL)=ALL
STRESS(SORT1,REAL,VOMISES,BILIN)=ALL
$ Subcases
DESOBJ(MIN) = 8000000
$ DESGLB Slot
$ DSAPRT(FORMATTED, EXPORT, END=SENS) = ALL

SUBCASE 1
ANALYSIS = MODES
DESSUB = 40000001
$ DRSPAN Slot
SUBTITLE=Modes Analysis
METHOD = 1
SPC = 100
VECTOR(SORT1,REAL)=ALL
SPCFORCES(SORT1,REAL)=ALL

SUBCASE 2
ANALYSIS = STATICS
DESSUB = 40000002
$ DRSPAN Slot
SUBTITLE=Static Analysis 1
LABEL = LOAD CONDITION 1
LOAD   = 300
        
```

### BDF Output - Design Model

```

*****
$*                                     *
$*                               Design Model                                *
$*                                                                           *
$*****
$
$                               Design variables - Type 1
$-----
$
$
$
DVPREL1 1000001 PROD    11     A
          100001  1.0
DVPREL1 1000002 PROD    12     A
          100002  1.0
DVPREL1 1000003 PROD    13     A
          100003  1.0
$
$
DESVAR 100001 X1         1.0    .001  100.
DESVAR 100002 X2         2.0    .001  100.
DESVAR 100003 X3         1.0    .001  100.
$
$
$
DLINK  1      100003              100001  1.0
$
$                               Design variables - Type 2
$-----
$
$
$
$
$                               Design Objective
$-----
$
$
DRESP1 0000000 r0      HEIGHT             3      3
$
        
```

### Download BDF Files

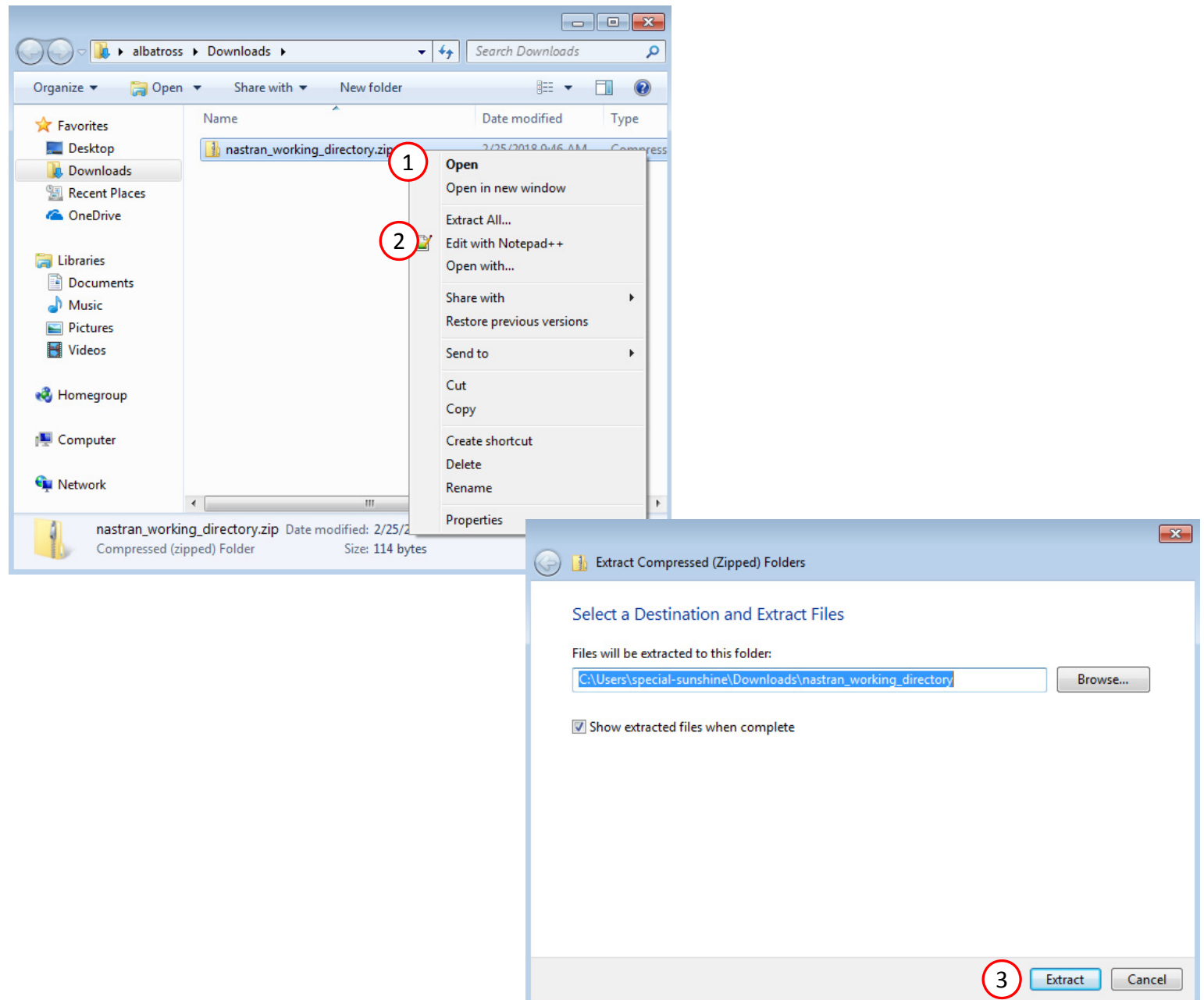
[Download BDF Files](#)

# Perform the Optimization with Nastran SOL 200

A new .zip file has been downloaded

1. Right click on the file
2. Click Extract All
3. Click Extract on the following window

- Always extract the contents of the ZIP file to a new, empty folder.



# Perform the Optimization with Nastran SOL 200

1. Inside of the new folder, double click on Start MSC Nastran
2. Click Open, Run or Allow Access on any subsequent windows
3. MSC Nastran will now start

- After a successful optimization, the results will be automatically displayed as long as the following files are present: BDF, F06 and LOG.
- One can run the Nastran job on a remote machine as follows:
  - 1) Copy the BDF files and the INCLUDE files to a remote machine.
  - 2) Run the MSC Nastran job on the remote machine.
  - 3) After completion, copy the BDF, F06, LOG, H5 files to the local machine.
  - 4) Click "Start MSC Nastran" to display the results.

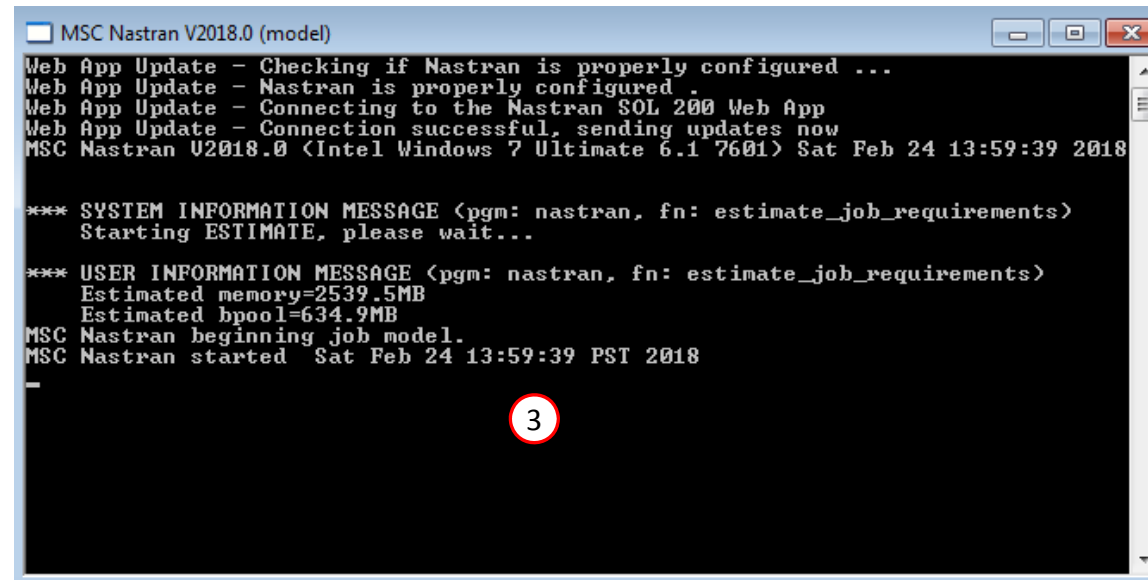
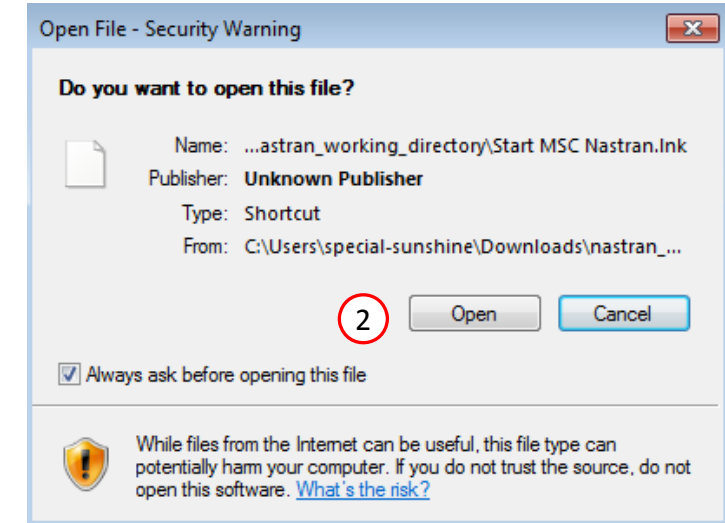
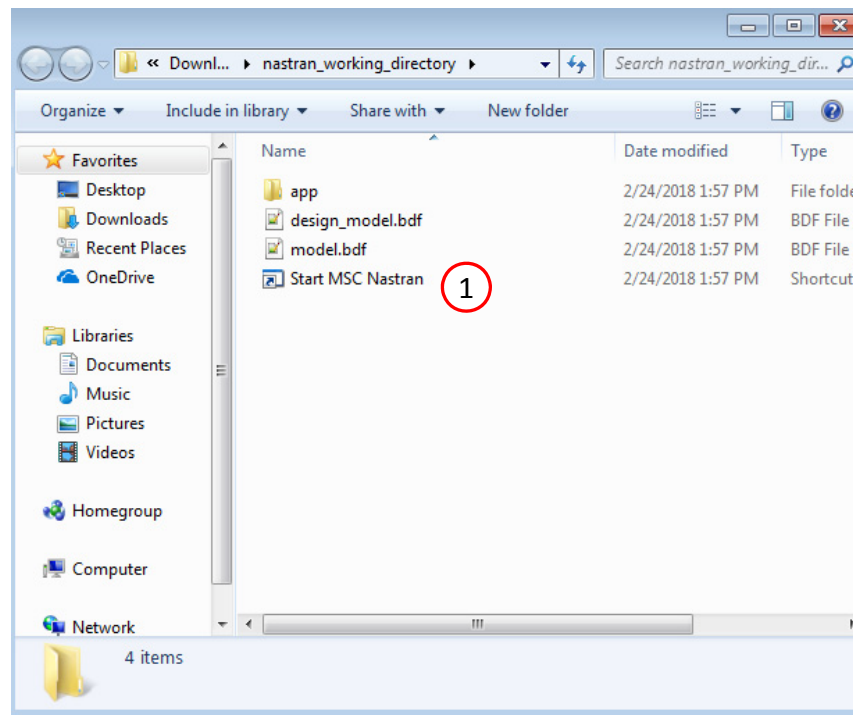
## Using Linux?

Follow these instructions:

- 1) Open Terminal
- 2) Navigate to the nastran\_working\_directory  
`cd ./nastran_working_directory`
- 3) Use this command to start the process  
`./Start_MSC_Nastran.sh`

In some instances, execute permission must be granted to the directory. Use this command. This command assumes you are one folder level up.

```
sudo chmod -R u+x ./nastran_working_directory
```




# Status

While MSC Nastran is running, a status page will show the current state of MSC Nastran

- The status of the MSC Nastran job is reported on the Status page. Note that Windows 7 users will experience a delay in the status updates. All other users of Windows 10 and Red Hat Linux will see immediate status updates.

## Nastran SOL 200 Web App - Status

 Python

 MSC Nastran

### Status

Name	Status of Job	Design Cycle	RUN TERMINATED DUE TO
model.bdf	Running	None	

# Review Optimization Results

After MSC Nastran is finished, the results will be automatically uploaded.

1. Ensure the messages shown have green checkmarks. This is indication of success. Any red icons indicate challenges.
2. The final value of objective, normalized constraints (not shown) and design variables can be reviewed.

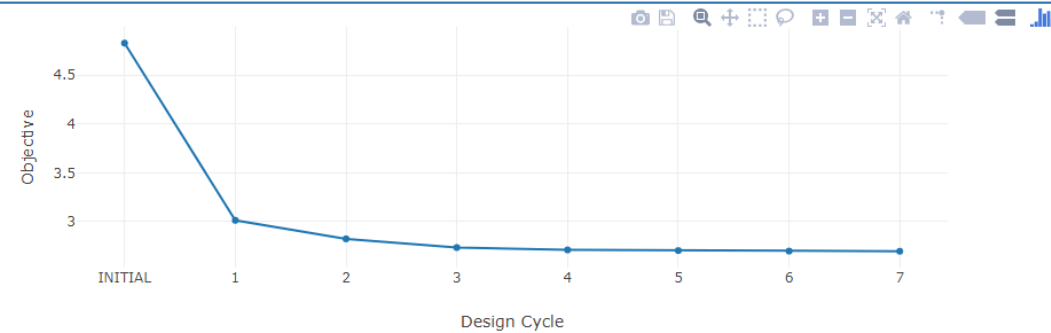
- The results shown are the outcome of a multidisciplinary optimization for both statics and modes.

## Final Message in .f06

1

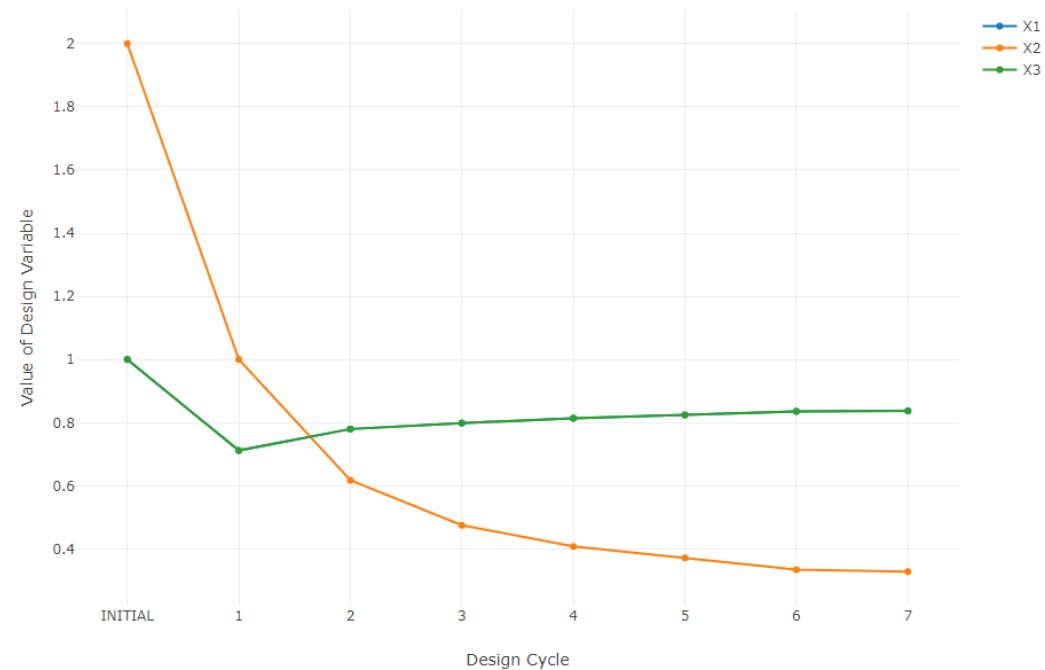
✓ RUN TERMINATED DUE TO HARD CONVERGENCE TO AN OPTIMUM AT CYCLE NUMBER = 7.

## Objective



2

## Design Variables



# Extra Information

---

# Assign Constraints to Load Cases (SUBCASES)

1. Hold down the SHIFT key on the keyboard and hover the mouse cursor over checkboxes to mark multiple checkboxes without mouse clicking frequently

Nastran SOL 200 Web App - Size Variables Objective Constraints **Subcases** Exporter Results Settings User's Guide Home

Step 1 - Assign constraints to subcases

Display Columns

Global Constraints  
SUBCASE 1  
SUBCASE 2  
SUBCASE 3  
SUBCASE 4  
SUBCASE 5

+ Options

Uncheck visible boxes Check visible boxes

Hold down the SHIFT key and hover over the cells to mark multiple checkboxes

Status	Label	Response Type	Analysis Type	Description	Global Constraints	SUBCASE 1	SUBCASE 2	SUBCASE 3	SUBCASE 4	SUBCASE 5	SUBCASE 6	SUBCASE 7	SUBCASE 8	SUBCASE 9	SUBCASE 10
					Analysis Types →	Normal Modes	Statics	Statics	Statics	Statics	Statics	Statics	Statics	Statics	Statics
	r1	DISP	STATICS	T1, T2 component(s) of displacement at grid 4			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	r2	STRESS	STATICS	Stress, Axial stress, of elements associated with PROD 11, 12, 13			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	r3	FREQ	MODES	Natural frequency of mode 1		<input checked="" type="checkbox"/>									



1. If you click Uncheck visible boxes, every visible box will be unchecked

1. If you click Uncheck visible boxes, every visible box will be unchecked

[illegible]

1. If you click Check visible boxes, every visible box will be checked

[illegible]

1. This icon will display SUBCASEs in which the constraint has been applied

Nastran SOL 200 questions? Email me: [christian@the-engineering-lab.com](mailto:christian@the-engineering-lab.com)

## Display Columns

Global Constraints

- SUBCASE 1
- SUBCASE 2
- SUBCASE 3
- SUBCASE 4
- SUBCASE 5
- SUBCASE 6

☐ Uncheck visible boxes☒ Check visible boxes

### + Options

Status	Label	Response Type	Analysis Type	Description	SUBCASE 2	SUBCASE 5	SUBCASE 6
					Statics	Statics	Statics
1	r1	DISP	STATICS	T1, T2 component(s) of displacement at grid 4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	r2	STRESS	STATICS	Stress, Axial stress, of elements associated with PROD 11, 12, 13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	r3	FREQ	MODES	Natural frequency of mode 1			

1. The Analysis Type bar will be shown automatically if constraints of different analysis types are created
2. Alternatively, the Analysis Type bar can be manually turned on by clicking *+Options* , then mark the checkbox for Use Multidisciplinary (MD) Optimization
3. The analysis type for each SUBCASE can be manually changed

Nastran SOL 200 questions? Email me: [christian@the-engineering-lab.com](mailto:christian@the-engineering-lab.com)

End of Tutorial