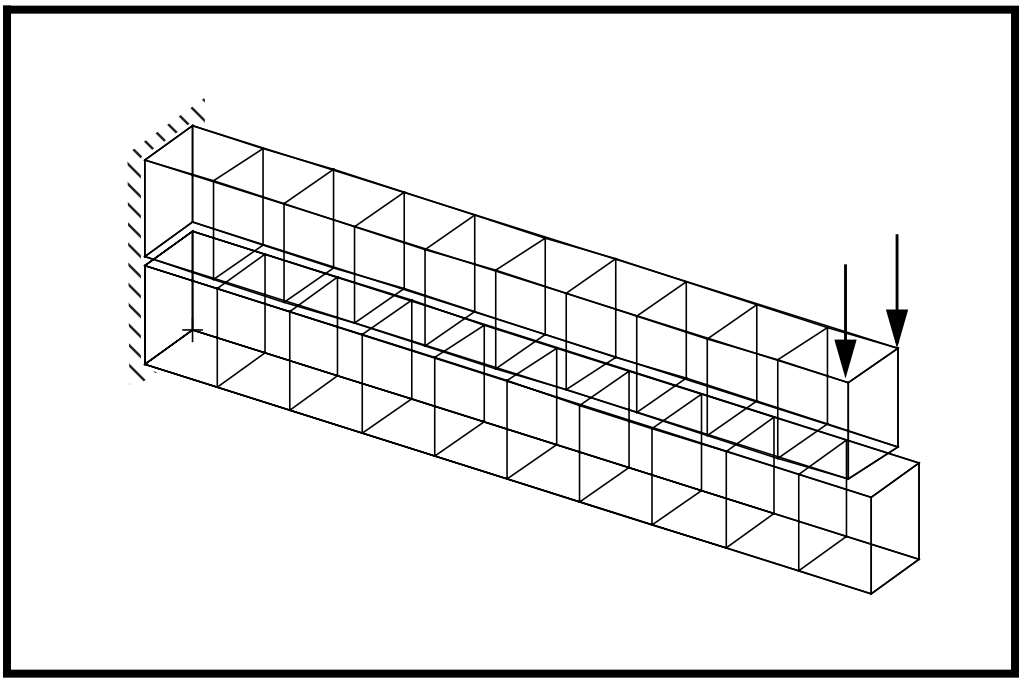
WORKSHOP PROBLEM 10b

Non-Linear Static Analysis for a 3-D Slideline Contact



Objectives:

- Demonstrate the use of slideline contact.
- Run an MSC/NASTRAN nonlinear static analysis.
- Create an accurate deformation plot of the model.
- Understand the linear vs. nonlinear behavior of the model.

Exercise Procedure:

1. Start up MSC/NASTRAN for Windows V3.0 and begin to create a new model.

Double click on the icon labeled MSC/NASTRAN for Windows V3.0.

On the *Open Model File* form, change the directory to **C:\temp**.

Open Model File: **prob10a**

(Optional) For users who wish to remove the default rulers in the work plane model, please do the following:

View/Options...

● **Tools and View Style**

Category: **Workplane and Rulers**

Draw Entity ☐

Apply

Cancel

2. Activate load set.

This would essentially redefine the load of the previous exercise.

Model/Load/Set...

ID: **1**

Category: **1..load_1**

OK

3. Define the nonlinear parameters for the model loading.

Since this is a nonlinear analysis, the nonlinear analysis load set options must first be defined.

Model/Load/Nonlinear Analysis...

Solution Type: ● **Static**

Default...

Basic / Number of Increments: **1**

Stiffness Updates / Method: **1..AUTO**

Output Control / Intermediate: **1..YES**

☒ Load **1e-6**

☒ Work **1e-10**

OK

4. Submit the job for analysis.

File/Export/Analysis Model...

Analysis Type: **10..Nonlinear Static**

OK

Change the directory to **C:\temp**.

File name: **prob10b**

Write

☒ **Run Analysis**

Advanced...

Problem ID: **Slideline contact**

OK

Under *Output Requests*, deselect everything except the following:

☒ **Displacement**

Also, change output request to:

Output Request: **2..Print and PostProcess**

Under *Analysis Case Requests*, enter the following:

☒ **Loads =** **1..load_1**

☒ **Constraint =** **1..constraint_1**

OK

OK

When asked if you wish to save the model, respond **Yes**.

Yes

This analysis process will take longer than the other workshops. So do not stop the analysis if you see N4W repeat its analysis process.

When the MSC/NASTRAN manager is through running, MSC/NASTRAN will be restored on your screen, and the *Message Review* form will appear. To read the messages, you could select **Show Details**. Since the analysis ran smoothly, we will not bother with the details this time.

Continue

When asked if it is "OK to Begin Reading File C:\TEMP\prob10b.xdb", respond **Yes**.

Yes

5. List the results of the analysis.

To list the results, select the following:

List/Output/Query...

Output Set:	**10..Case 4 Step 1.000000**
Category:	**1..Displacement**
Entity:	● **Node**
ID:	**88**
OK	*(Select a load application point.)*

NOTE: You may want to expand the message box in order to view the results. To do this, double click on the message box. Adjust the size of the box to your preference by dragging the top border downward.

What are the x and y displacements of Node 88 at the end of the first subcase?

T1= _____

T2= _____

6. Display the deformed plot on the screen.

First, you may want to remove the labels and LBC markers in order to give a better view of the deformation.

View/Options...

Quick Options...

Labels Off

☐ **Coordinate System**

☐ **Load - Force**

☐ **Constraint**

Done

OK

Plot the deformation of the structure.

View/Select...

Deformed Style: ● **Deform**

Contour Style: ● **Contour**

Deformed and Contour Data...

Data Selection/Category: **1..Displacement**

Output Set: **10..Case 4 Step 1.000000**

Output Vectors/Deformation: **1..T1 Translation**

Output Vectors/Contour: **1..T1 Translation**

OK

OK

In order to see the deformation results accurately, you will need to turn off the display scaling of the actual deformation.

View/Options...

Category: ● **PostProcessing**

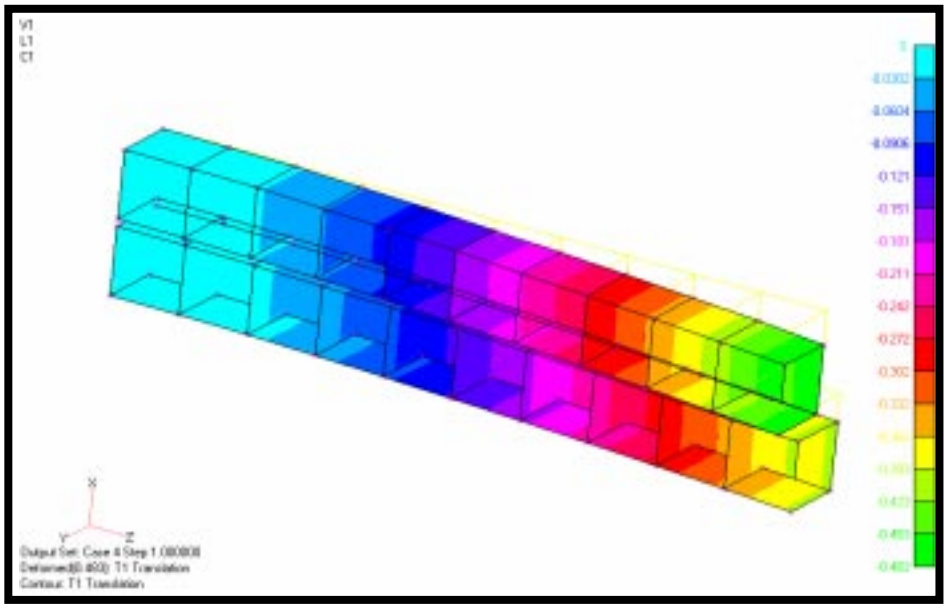
Options: **Deformed Style**

% of Model (Actual) ☐

OK

The XY View should appear as follows:

Figure 10b.2:



Notice the difference between the result obtained in this nonlinear analysis versus the result from the previous linear analysis. Ths lower beam actually deformed due to its contact with the upper beam. Also note the amount of deflection of the upper beam has decreased due to the additional stiffness added to the overall structure by the lower beam. In a nonlinear analysis, the stiffness matrix of the model is updated continuously to account for any changes in the overall stiffness of the model.

This concludes the exercise.

Step 1	T1	-0.48377
	T2	0.00005487