

WORKSHOP 12a

Obtaining Material Properties Using the Materials Selector

Materials Selector

Select Database... Query... Column Headers...

Query Command

-Apply- Clear

Current Database: mil5.des Auto Execute

	CNAME		
Row 1 of 95	15-5PH Stainless Steel		
Row 2 of 95	17-4PH Stainless Steel		
Row 3 of 95	17-7PH Stainless Steel		
Row 4 of 95	2014 Aluminum Alloy		
Row 5 of 95	2017 Aluminum Alloy		
Row 6 of 95	2024 Aluminum Alloy		
Row 7 of 95	2025 Aluminum Alloy		

Selected Cell Data

CNAME (Common Name): 15-5PH Stainless Steel

Display Material's Properties...

Objective:

- Select a material using the Materials Selector and apply it to a plate.



Model Description:

In this exercise you will create a rectangular plate, and build its finite element model. The Materials Selector will be used to choose a material for the plate from on-line material databases. The geometry and material constants are shown below.

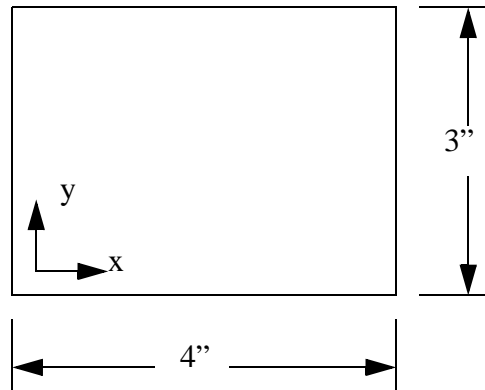


Figure 12a-1

Analysis Code:	MSC/NASTRAN
Plate Thickness:	0.1"
Finite Element Mesh	
Element Type:	Quad4
Global Edge Length:	0.5"
Material Constants	
Material Common Name:	Aluminum Alloy
Directional Variance of Properties:	Isotropic
Modulus of Elasticity in Tension:	$E \approx 1.1E7$ psi
Density:	$\rho \leq 0.1$ lb/in ³

Table 12a-1

Suggested Exercise Steps:

- Create a new database named **aluminum_plate.db**.
- Change the analysis code to MSC/NASTRAN. The model's maximum dimension is 4 units.
- Create the geometry as shown in Figure 12a-1. Create the

finite element mesh using the information in Table 12a-1.

- Use the Materials Selector to access the MIL-5 Handbook (Mil5f_cn2.des).
- Select an appropriate material based on the values in Table 12a-1.
- Apply the material to the plate.

Exercise Procedure:

1. Create a new database and name it **aluminum_plate.db**.

File/New...

New Database Name

aluminum_plate

OK

2. Change the analysis code to MSC/NASTRAN. The model's maximum dimension is 4 units.

New Model Preference

Tolerance

◆ **Based on Model**

Approximate Maximum Model Dimension

4

Analysis Code:

MSC/NASTRAN

OK

3. Create the geometry as shown in Figure 12a-1. Create the finite element mesh using the information in Table 12a-1.

◆ Geometry

Action:

Create

Object:

Surface

Method:

XYZ

Vector Coordinate List

<4, 3, 0>

Apply

Now the finite element model will be created.

◆ **Finite Elements**

<i>Action:</i>	<input type="text" value="Create"/>
<i>Object:</i>	<input type="text" value="Mesh"/>
<i>Type:</i>	<input type="text" value="Surface"/>
<i>Global Edge Length</i>	<input type="text" value="0.5"/>
<i>Element Topology</i>	<input type="text" value="Quad4"/>
<i>Mesher</i>	◆ Isomesh
<i>Surface List</i>	<input type="text" value="Surface 1"/>
<input type="button" value="Apply"/>	

- Use the Materials Selector to access the MIL-5 Handbook (Mil5f_cn2.des).

Accessing
a Materials
Database

◆ **Materials**

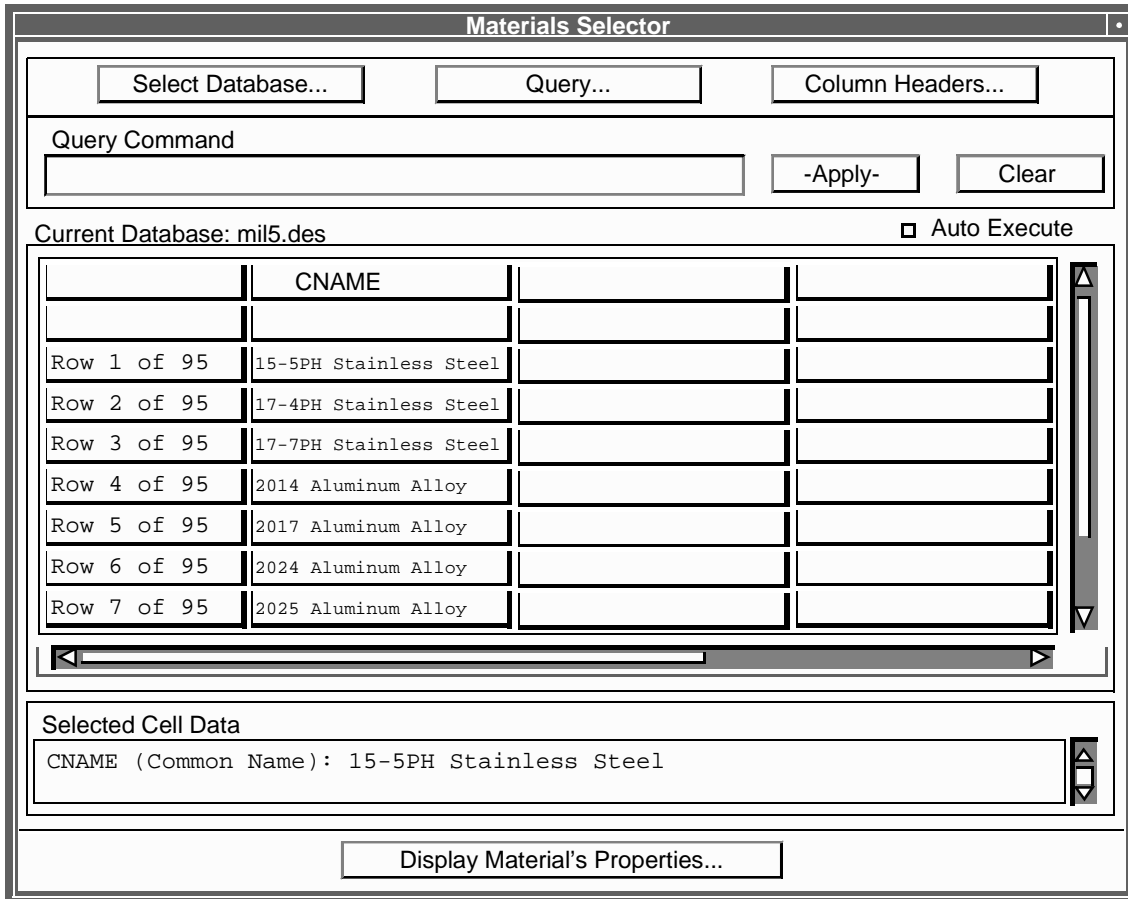
<i>Action:</i>	<input type="text" value="Create"/>
<i>Object:</i>	<input type="text" value="Isotropic"/>
<i>Method:</i>	<input type="text" value="Materials Selector"/>
<i>Databases</i>	<input type="text" value="mil5.des"/>
<input type="button" value="Apply"/>	

Click **OK** on the message window.

<i>Material Name</i>	<input type="text" value="mat"/>
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The *Material Selector* form will appear. It contains a spreadsheet of all of the materials in the **mi15.des** database. The top row lists the column headers, the second row lists the units, if applicable, for the column, and the third row on give the related information for the

material. When the **mil5.des** database is brought into MSC.Patran, materials are shown in the Materials Selector spreadsheet with the CNAME listed as shown in the following form.



To obtain an idea of how many material types are present in the database, scroll down the spreadsheet using the scroll bar.

If you wanted to select a different database, you would click on the **Select Database...** button. Click on that button now. You are returned to the *Materials Selector Databases* form. To change to a different database, you would click on a different database in the *Databases* listbox, and then click on the **Apply** button. Since you already have selected the database that you want, click on the **Cancel** button to return to the *Material Selector* form.

5. Select an appropriate material based on the values in Table 12a-1.

You need to select which attributes of the material will be displayed in the spreadsheet. The selected attributes will be extracted from the database and applied to the material in MSC.Patran.

Column Headers...

Adding Columns to the Spreadsheet

The *Materials* form will update. Scroll down the *Attributes* listbox of the *Materials* form, and select **DENS**.

Attributes

DENS

Note that DENS is added to the textbox in the *Attribute Information* frame. Add **E11T** and **NU12** in the same manner.

Apply

The spreadsheet is updated with the added properties. Use the scroll bar on the spreadsheet to display the added attributes. The spreadsheet is shown below for your reference.

The screenshot shows the Materials Selector dialog box. At the top, there are buttons for 'Select Database...', 'Query...', and 'Column Headers...'. Below these is a 'Query Command' text box with '-Apply-' and 'Clear' buttons. The 'Current Database' is 'mil5.des' and 'Auto Execute' is checked. The main area is a spreadsheet with the following data:

	CNAME	DENS	E11T
		lb/in^3	psi
Row 1 of 179	15-5PH Stainless Steel	0.283	2.85e+07
Row 2 of 179	15-5PH Stainless Steel	-0-	-0-
Row 3 of 179	17-4PH Stainless Steel	0.282	2.85e+07
Row 4 of 179	17-4PH Stainless Steel	0.283	2.85e+07
Row 5 of 179	17-4PH Stainless Steel	0.284	2.85e+07
Row 6 of 179	17-4PH Stainless Steel	-0-	-0-
Row 7 of 179	17-7PH Stainless Steel	0.276	2.9e+07

Below the spreadsheet is a 'Selected Cell Data' section showing 'CNAME (Common Name): 15-5PH Stainless Steel'. At the bottom of the dialog is a 'Display Material's Properties...' button.

Click on the **Units** option menu on the *Materials* form and select **SI-Customary** to change the spreadsheet to SI units. Since this problem is performed in English units, click on the **Units** option menu again and select **US-Consistent**.

Changing Units

Querying the Database

Initially the *Query Command* databox in the *Materials Selector* form is blank. The Query Command is used to filter the material list to generate a smaller, more manageable one. Filters can be set to show only materials with specific ranges or types of attributes. Clicking on the **Apply** button executes the Query Command. Clicking on the **Clear** button removes the text from the *Query Command* databox.

There are two ways to change the *Query Command* databox: (1) Type directly into the *Query Command* databox, or (2) Click on the **Query...** button to access the *Materials Selector Query Panel* form. The first method is quick if you know all the syntax. The second method requires no memorization. Click on the **Query...** button now.

Query...

The *Materials Selector Query Panel* form will open.

Attributes

CNAME

You will see information on CNAME appear in *Attribute Information* textbox. **CNAME** appears in the *Build the Query Command* databox. Click on the **like** button

Select an Operator

like

Type ***Alum*** in the *Build the Query Command* databox

Build the Query Command

CNAME like '*Alum*'

Apply

The asterisks act as wild cards in the manner of a UNIX command. Clicking on the **Apply** button filters the spreadsheet to only include materials with *Common Names* which contain the string **Alum**. The *Material Selector* form appears with the spreadsheet showing a list of materials that comply with the query. Use the scroll bar to check the listing. Note the *Query Command* databox has been updated.

Now you will filter the list based on the material properties listed in Table 12a-1.

Query...

Select an Operator

and

Attributes

DENS

Select an Operator

<=

Type in

0.1

Select an Operator	<input type="text" value="and"/>
Attributes	<input type="text" value="E11T"/>
Select an Operator	<input "="" type="text" value=">="/>
Type in	<input type="text" value="11E6"/>

Build the Query Command

CNAME like '*Alum*' and DENS <=0.1 and E11T >= 11000000

The *Materials Selector* form reappears with only one material in the spreadsheet.

On the *Materials* form enter the name, **alum_2090**, in the *Material Name* databox. Next, click on any cell in Row 1 of 1 in the *Materials Selector* form to select that material.

This next form allows you to specify the exact material you require. Click in any cell of Row 1 of 2 to select that material and then on the **Create Material** button to create the material. You will be warned that certain material properties were not specified. Click **Yes** to apply null data to the database for these values.

On the *Materials* form, you will see that **alum_2090** has been created (its name is listed in the *Existing Materials* box). Also on the *Materials* form, the *Mapped Properties* textbox lists values for the material's attributes.

Click on the **Properties Mapping...** button on the *Materials* form. The *Materials Selector Database Attribute Mapping* form appears. As you page down, you will see the properties. (lower left corner of form-page up and down)

You will also see two *Attribute* option menus. Click on the left one and you see four possible picks: **Min**, **Max**, **Cnt**, and **Units**. The **Min** and **Max** are the minimum and maximum values of the attribute. **Cnt** (count) is the number of materials which satisfy the query condition. **Units** displays the units currently used for the attribute.

To exit the *Material Selector*, change the *Method* option menu on the *Materials* form to **Manual Input**. You will see the material you created in the *Existing Materials* databox.

**Importing the
Material into
MSC.Patran**

**Relating the
Material to
the Model**

6. Apply the material to the plate.

◆ Properties

Action:

Create

Dimension:

2D

Type:

Shell

Property Set Name

thin_plate

Options

Homogeneous

Standard Formulation

Input Properties...

Material Name

m:alum_2090

Thickness

0.1

OK

Select Members

Select Entire Model

Add

Apply

File/Quit...