THE UNIVERSITY OF RHODE ISLAND

EGR 106
Foundations of Engineering II

Lecture 12 – Part B
Design Project - Week 3

THINK BIG WE DO℠

This Week's Topics

Design Project Assignment (see Part A)

Engineering Design Process

Adding color & texture

Engineering Design Process

Steps in design process (recall from EGR 105)

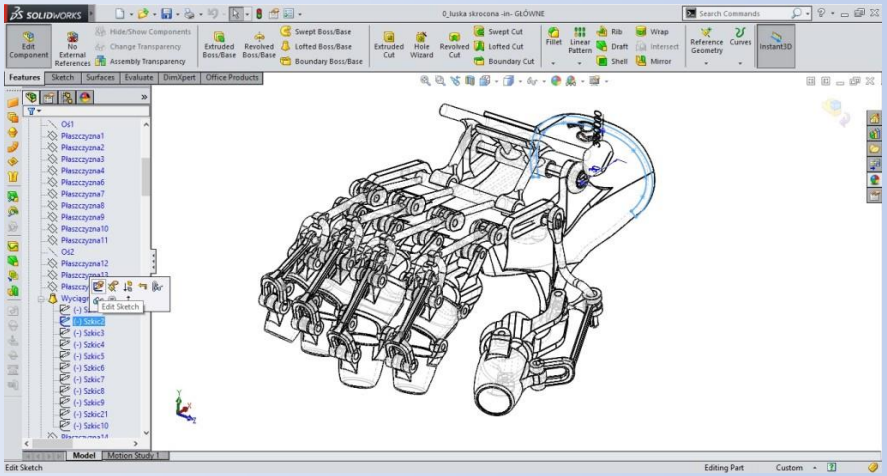
Our focus in EGR 106 project

Prototyping and Simulation

Recent developments in software and manufacturing technologies have led to widespread use of computer aided design (CAD), simulation and physical prototyping.

Example – Design of 3D printed rehabilitation orthosis

(http://blog.zmorph3d.com/3d-printed-rehabilitation-orthosis/)



Solidworks CAD model

3D Printed Prototype

Commercial CAD and Simulation Software

AutoCAD

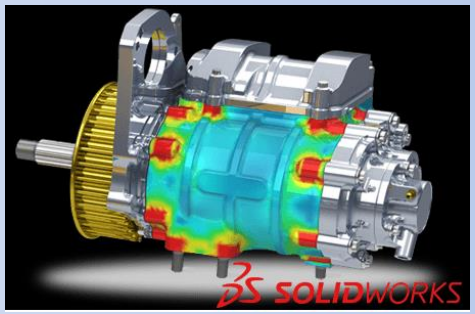
CATIA

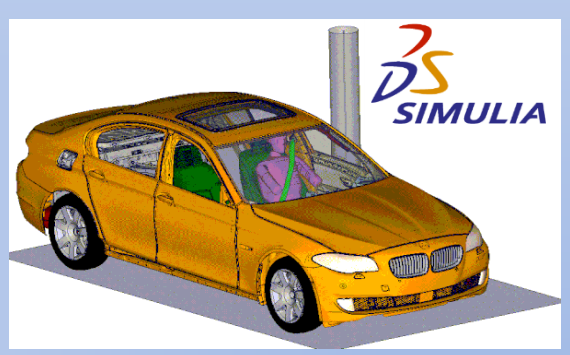
Rhinoceros

COMSOL

AUTODESK® INVENTOR®

SketchUp





3D Modeling

To gain insight into 3D computer modeling, we will use Matlab to create 3D objects using functions that add or subtract basic shapes:

- box, cylinder_x, cylinder_y, cylinder_z, sphere, and segment

Functions for viewing your design:

- preview, model_gen, model_animate

These functions have been introduced over the past two weeks

Design Project

Design Project Objectives

Working in teams, develop a Matlab code that generates a unique 3D design of a component of your choosing and give an oral presentation of the final design.

General Education Outcomes

Full Coverage

- Arts & Design

Partial Coverage

- Mathematical, Statistical, or Computational Strategies

Adding Color and Texture to your Design

Matlab provides eight basic colors:

red, green, blue, yellow, magenta, cyan, black and white

While other colors can be created in Matlab, we will modify basic colors in a "post-processing" step by replacing "default" color .jpg files with "custom" color files

In addition to solid colors, we can add texture, which can be defined as tactile quality of the surface, or the visual "feel" of a surface

Defining colors

Default color definition files (Week 10 and 11 examples):

colors.mtl, red.jpg, green.jpg, blue.jpg, yellow.jpg, magenta.jpg, cyan.jpg, black.jpg, white.jpg

Custom color definition files (included in week_12.zip):

colors.mtl (custom version), 1.jpg, 2.jpg, 3.jpg, 4.jpg, 5.jpg, 6.jpg, 7.jpg, 8.jpg

Default Colors (Matlab)

Number	Color	jpg image
1	red	
2	green	
3	blue	
4	yellow	

Number	Color	jpg image
5	magenta	
6	cyan	
7	white	
8	black	

Colors.mtl file

```
newmtl red
Ka 1.000000 1.000000 1.000000
Kd 1.000000 1.000000 1.000000
Ks 0.000000 0.000000 0.000000
Tr 1.000000
illum 1
Ns 0.000000
map_Kd red.jpg

newmtl green
Ka 0.200000 0.200000 0.200000
Kd 0.000000 1.000000 0.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd green.jpg

    •
    •
    •

newmtl white
Ka 0.200000 0.200000 0.200000
Kd 1.000000 1.000000 1.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd white.jpg

newmtl black
Ka 0.200000 0.200000 0.200000
Kd 0.000000 0.000000 0.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd black.jpg
```

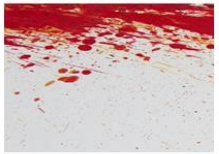
Default

```
newmtl red
Ka 1.000000 1.000000 1.000000
Kd 1.000000 1.000000 1.000000
Ks 0.000000 0.000000 0.000000
Tr 1.000000
illum 1
Ns 0.000000
map_Kd 1.jpg

newmtl green
Ka 0.200000 0.200000 0.200000
Kd 0.000000 1.000000 0.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd 2.jpg

    •
    •
    •

newmtl white
Ka 0.200000 0.200000 0.200000
Kd 1.000000 1.000000 1.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd 7.jpg

newmtl black
Ka 0.200000 0.200000 0.200000
Kd 0.000000 0.000000 0.000000
Ks 1.000000 1.000000 1.000000
Tr 0.000000
illum 2
Ns 0.000000
map_Kd 8.jpg
```

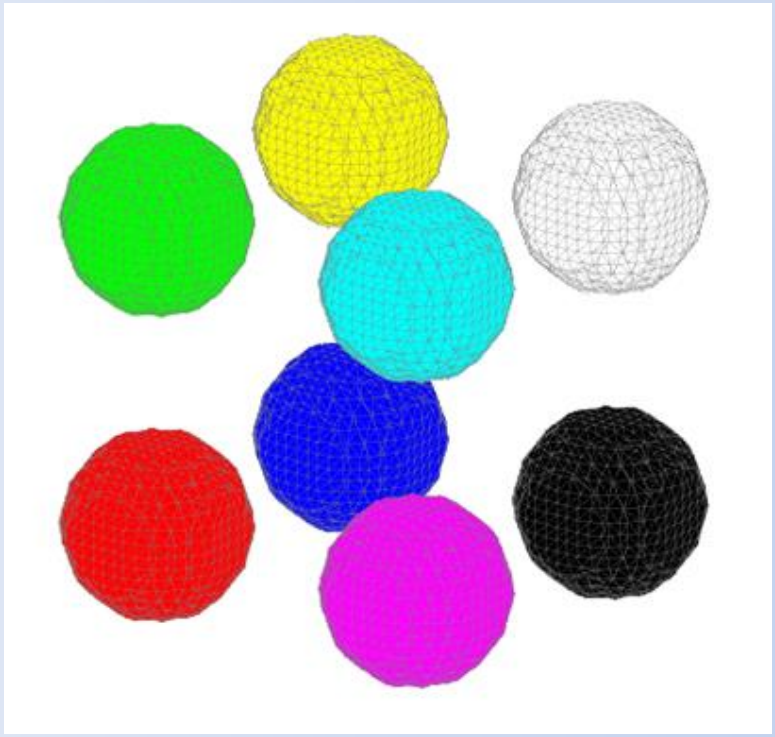
Custom

Custom Colors / Textures Used For “eight_balls” example

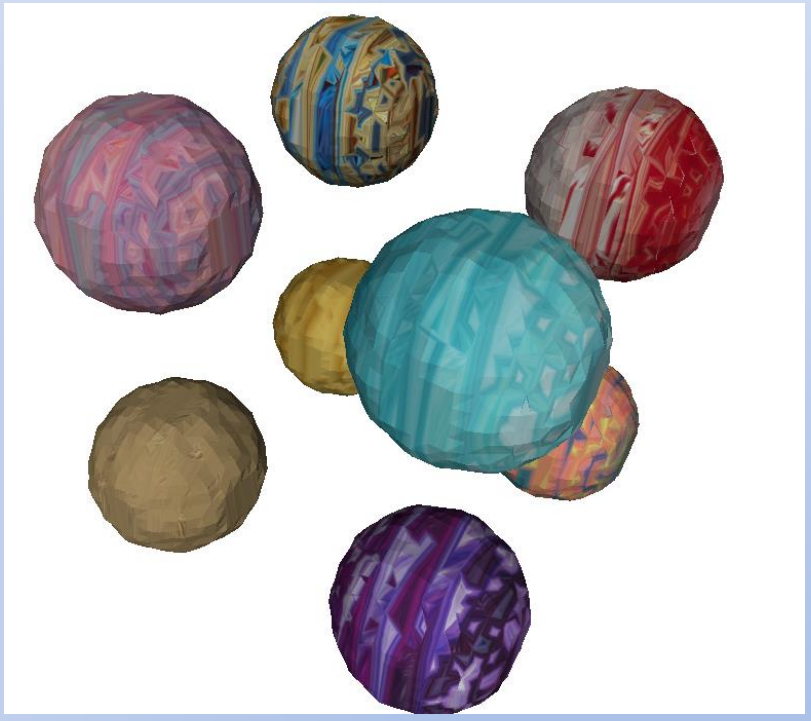
Number	Matlab Color	jpg image
1	red	
2	green	
3	blue	
4	yellow	

Number	Matlab Color	jpg image
5	magenta	
6	cyan	
7	white	
8	black	

eight_balls.obj
(viewed in Meshlab)



Default Colors



Custom Colors

Creating Custom Colors and Texture

Any .jpg image file can be used

Option 1 - Microsoft Paint

Edit colors =>select desired color => Add to custom color => Fill with color => Save as _.jpg

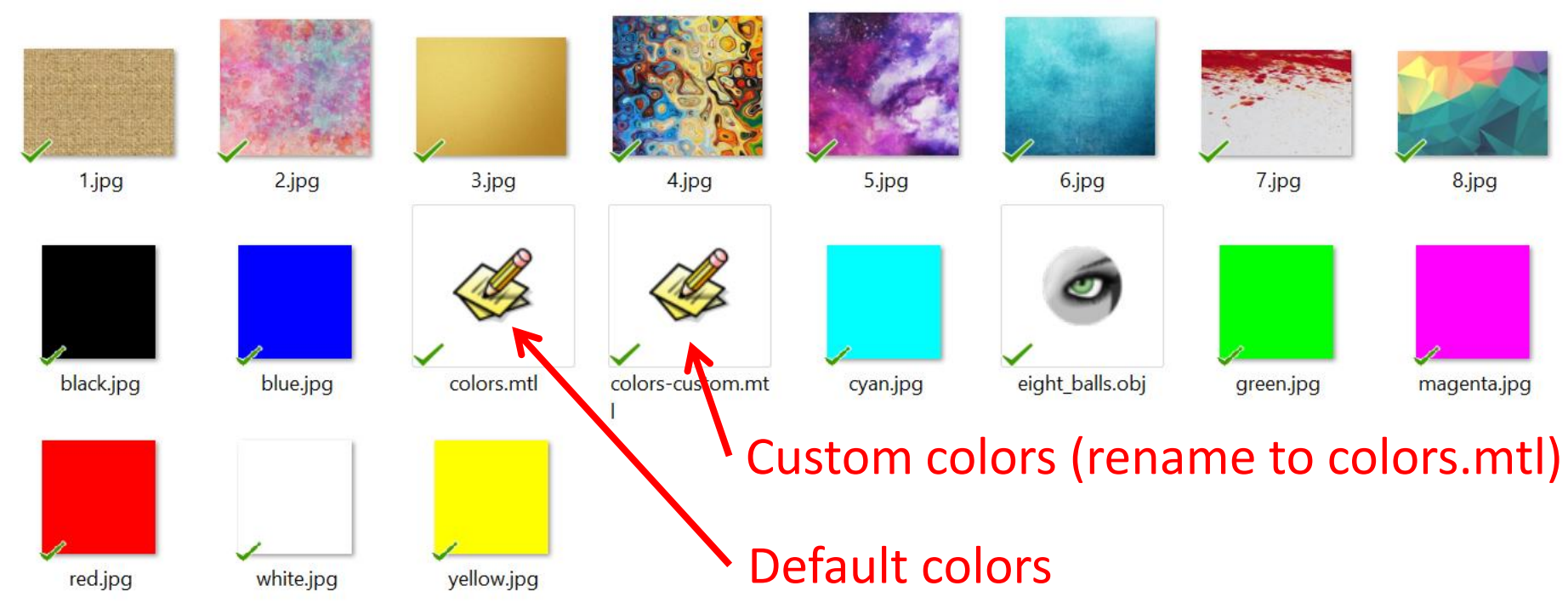
Option 2 – Download image from internet

http://www.solidbackgrounds.com => find desired color => right click => save image as.. => .jpg

Option 3 – Download texture image

Google search => texture => images => find desired color => right click => save image as.. => .jpg

Files for Viewing eight_balls (Week_12.zip on Brightspace)

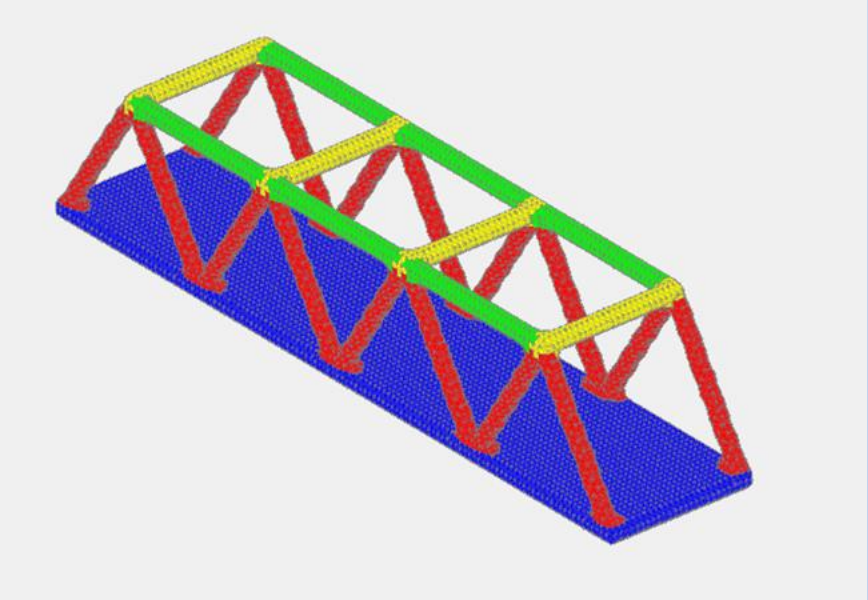


Custom colors for truss

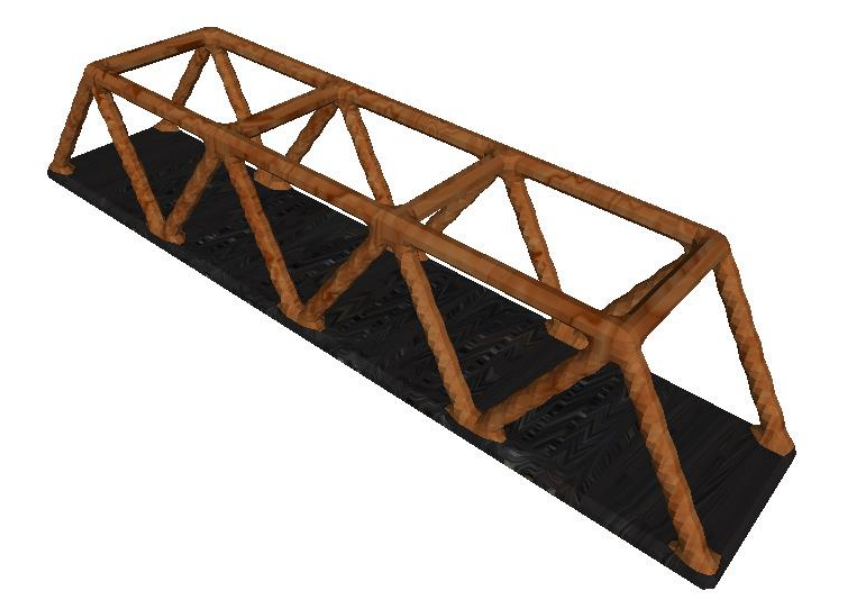
Replace 1.jpg, 2.jpg and 4.jpg (originally red, green and yellow) with:

Replace 3.jpg, (originally blue) with:

Truss.obj – with custom colors



Default Colors



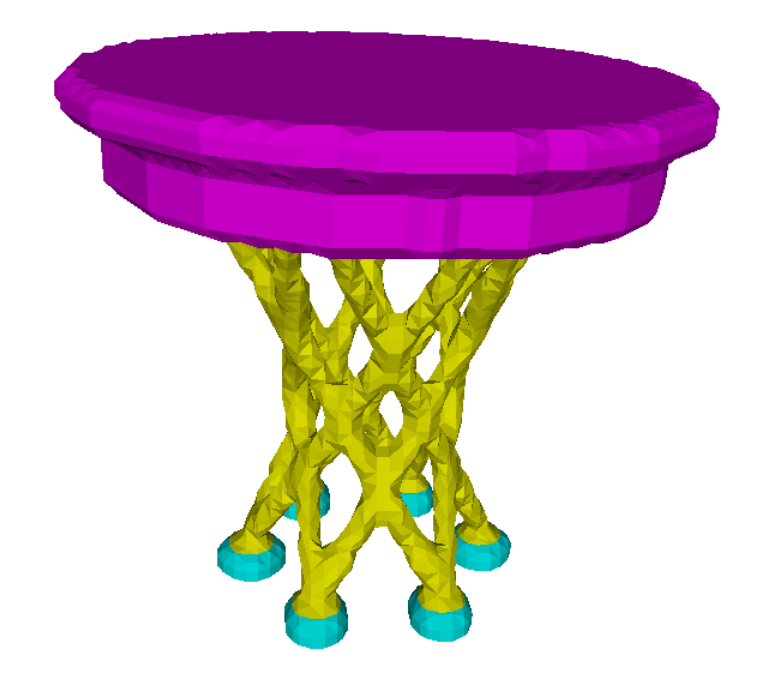
Custom Colors

table.obj (week 11 assignment)

Replace 4.jpg and 6.jpg (originally yellow and cyan) with:

Replace 5.jpg, (originally magenta) with:

Table.obj (week 11 assignment)



Default Colors

Custom Colors

Questions / Problems

Contact me at:

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