COMPUTER-AIDED ANALYSIS AND DESIGN
MAE 292

Professor Nick Gravish

L2 CAD Operations

Logistics

- HW #1 will be posted to Canvas this afternoon, due in 1 week.

- Let me know if you have any issues viewing the Zoom videos.

- I will do my best to post slide PDF's before the lecture so you can follow along, apologies if some don't get there in time.

- I have posted the Matlab code we will be using in the lecture to Canvas. Feel free to follow along.

Computer representation of geometry and operations

- With computer-aided drafting operations, we use 2D windows to view and manipulate virtual 2D and 3D objects

- The objective of this lecture is to introduce you to methods that computer programs use to achieve the illusion of working with real objects as an interface

- We look at a few key *transformations*

- *Scaling*: change an object's size

- *Translation*: panning or moving an object

- *Rotation about origin*

- *Rotation about an arbitrary point*

- *Reflection*

- *Zooming* (what's the difference between scaling and zooming?)

- *Clipping* (traditionally a **difficult** problem)

Computer representation of geometry and operations

- Some useful resources in addition to the chapters on Canvas can be found at the library in electronic form and online.

1. **Applied geometry for computer graphics and CAD / Duncan Marsh**
   Marsh, Duncan, 1961-
   London ; New York : Springer, 2005

   Go to Electronic Version »
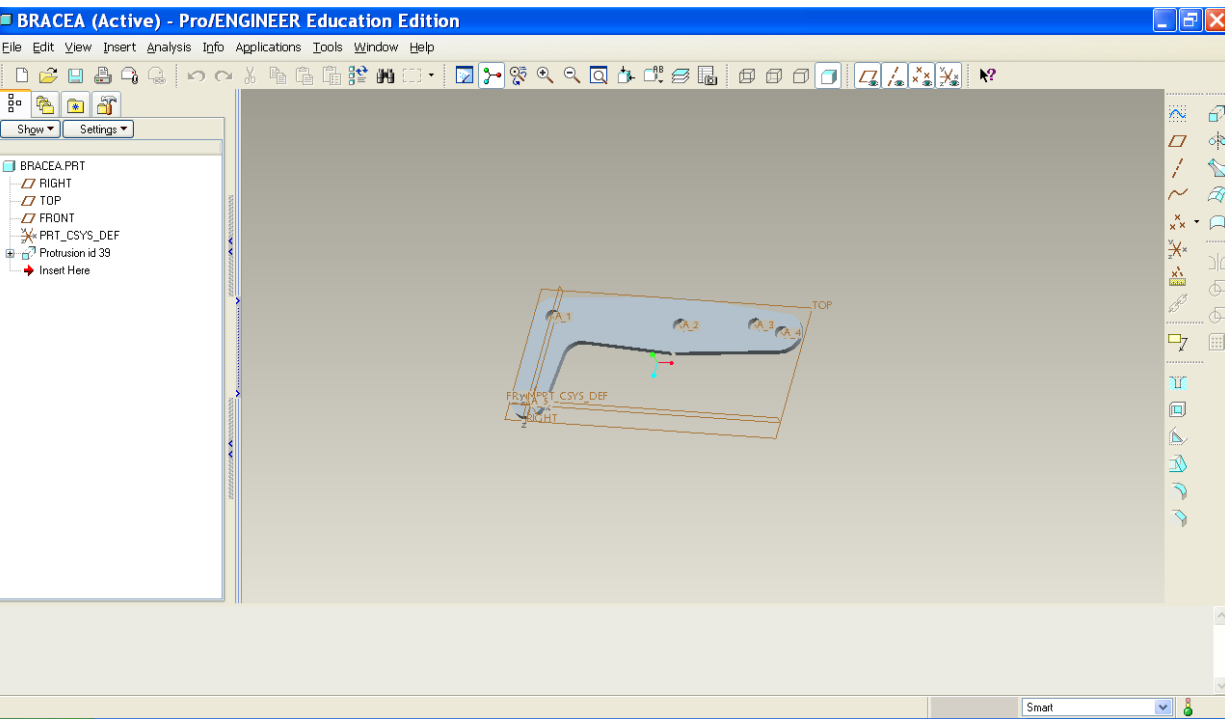   *SpringerLink. Restricted to UC campuses*
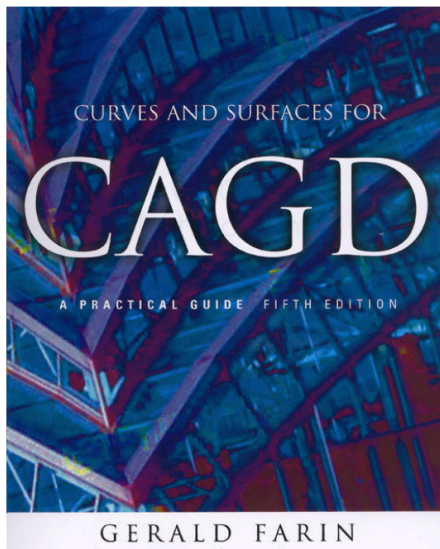
Curves and Surfaces for CAGD
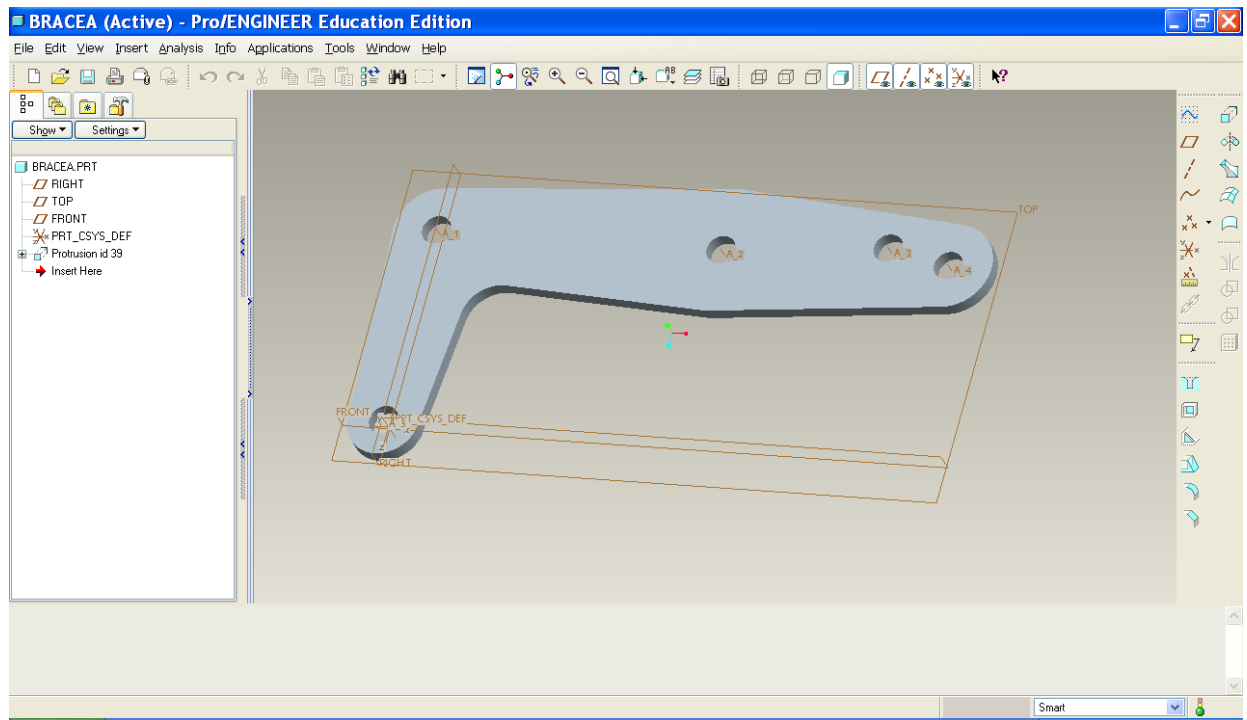A Practical Guide
5th edition

by Gerald Farin

Published by Morgan-Kaufmann

Published 2002
499 pages

ISBN 1-55860-737-4

Scaling
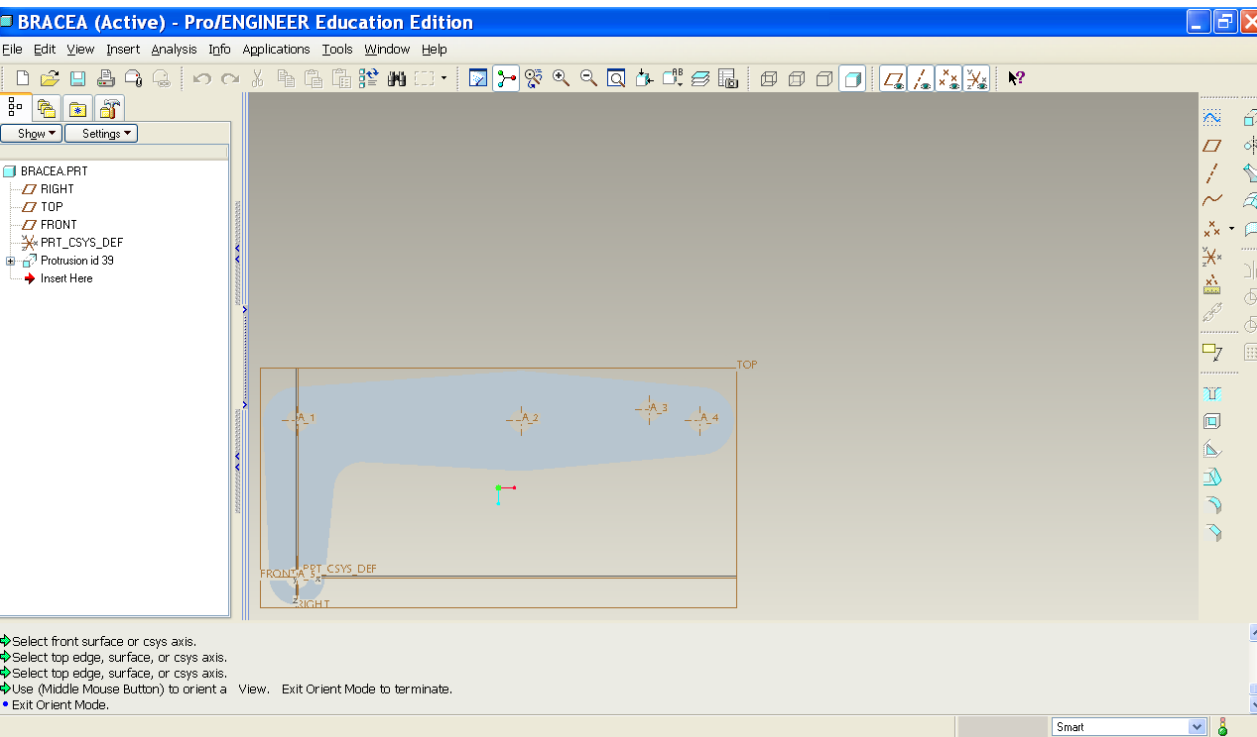
Translation
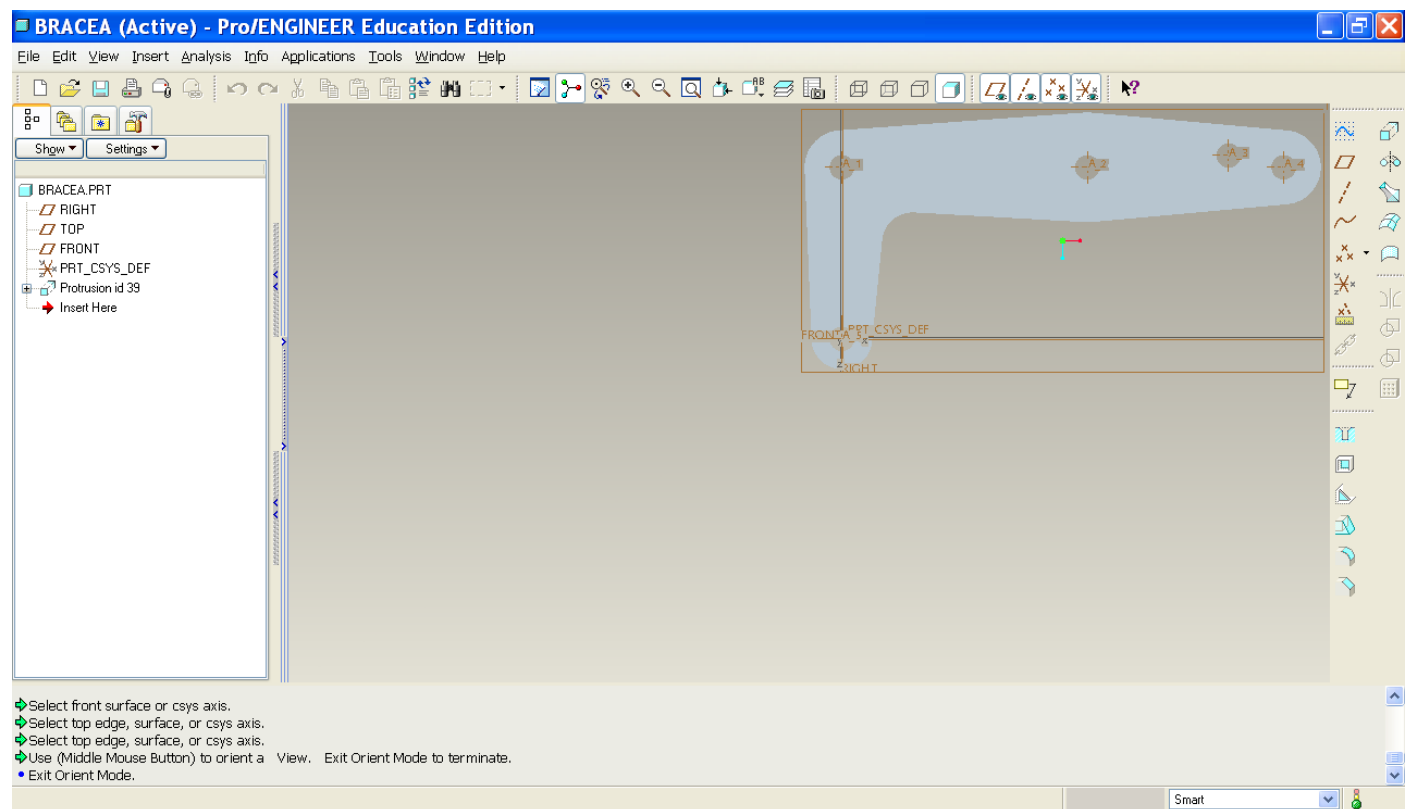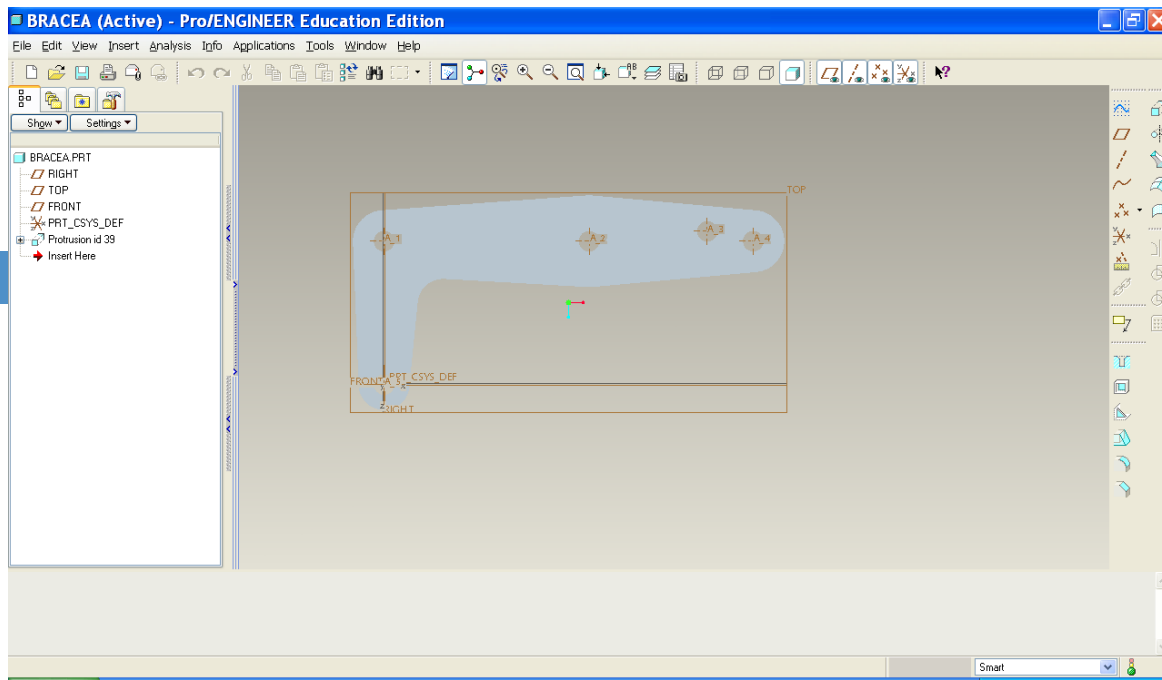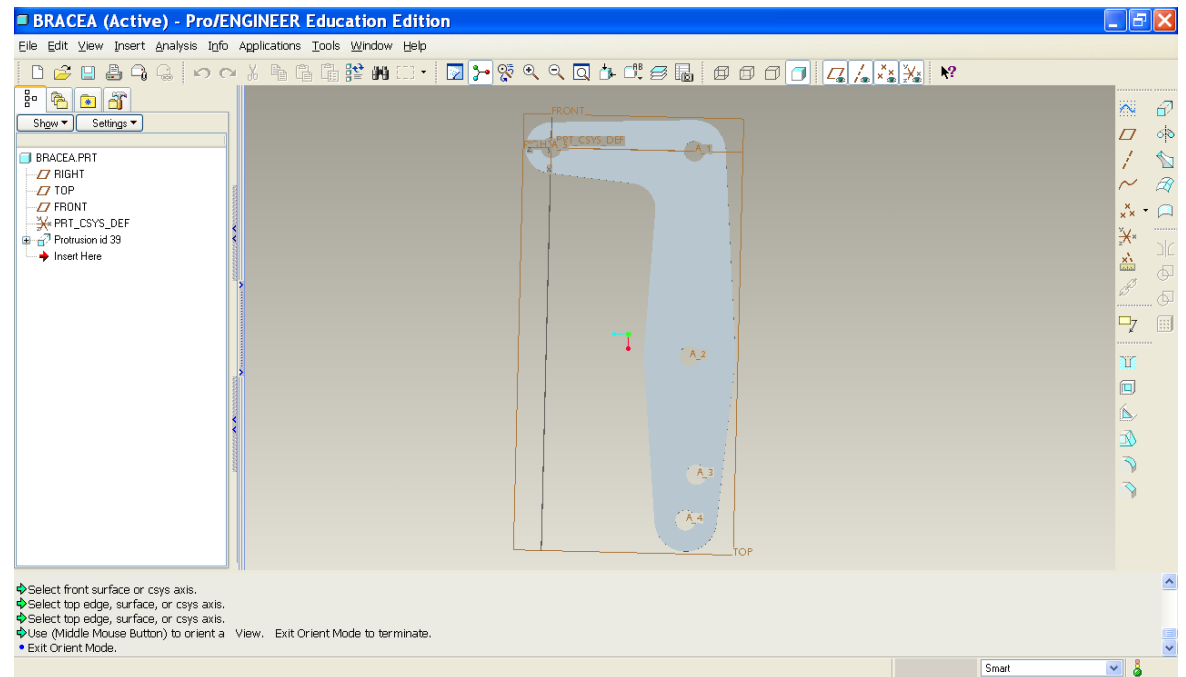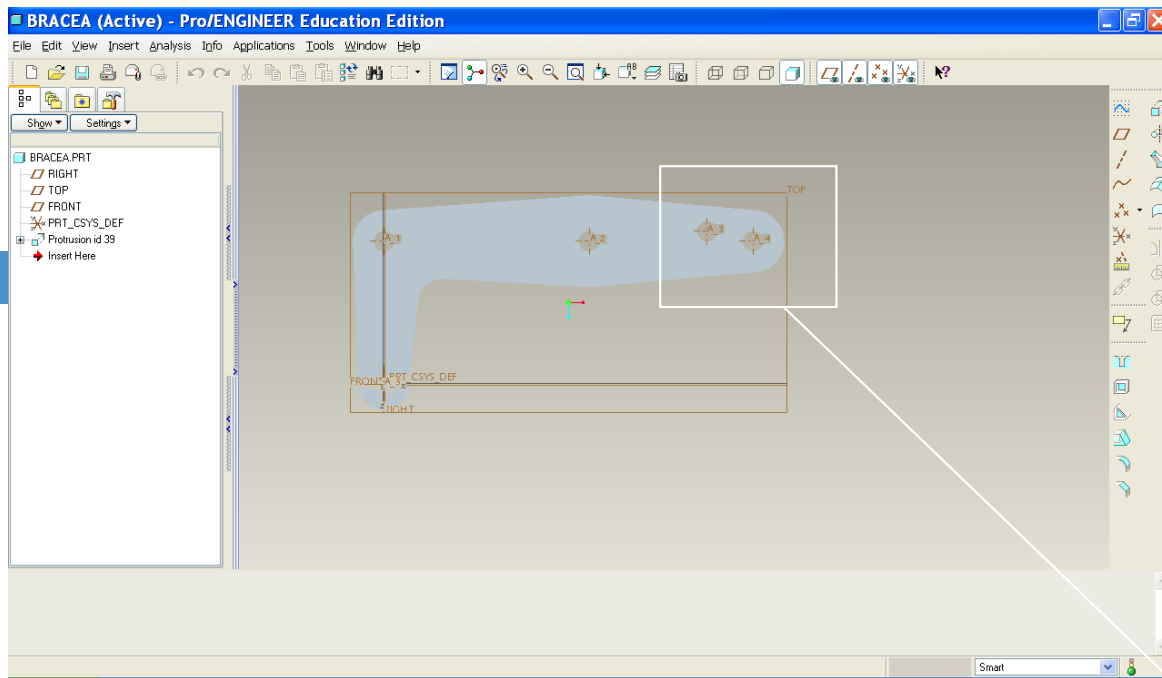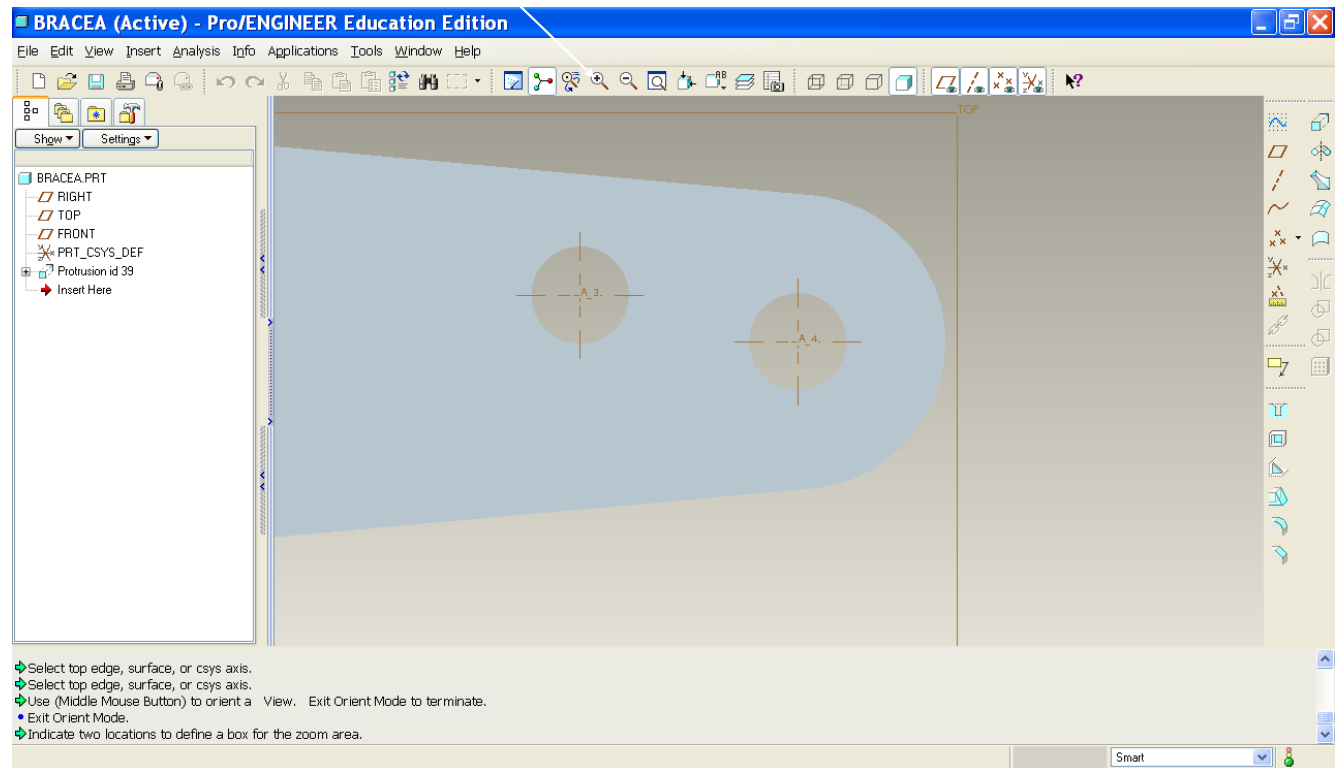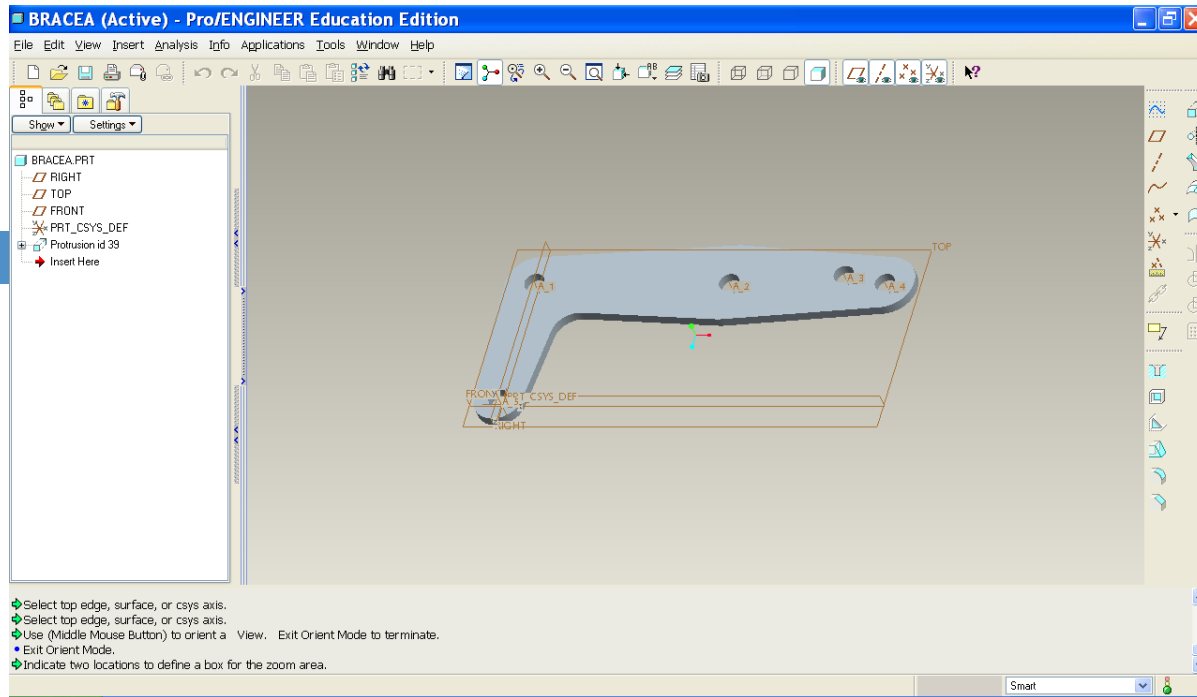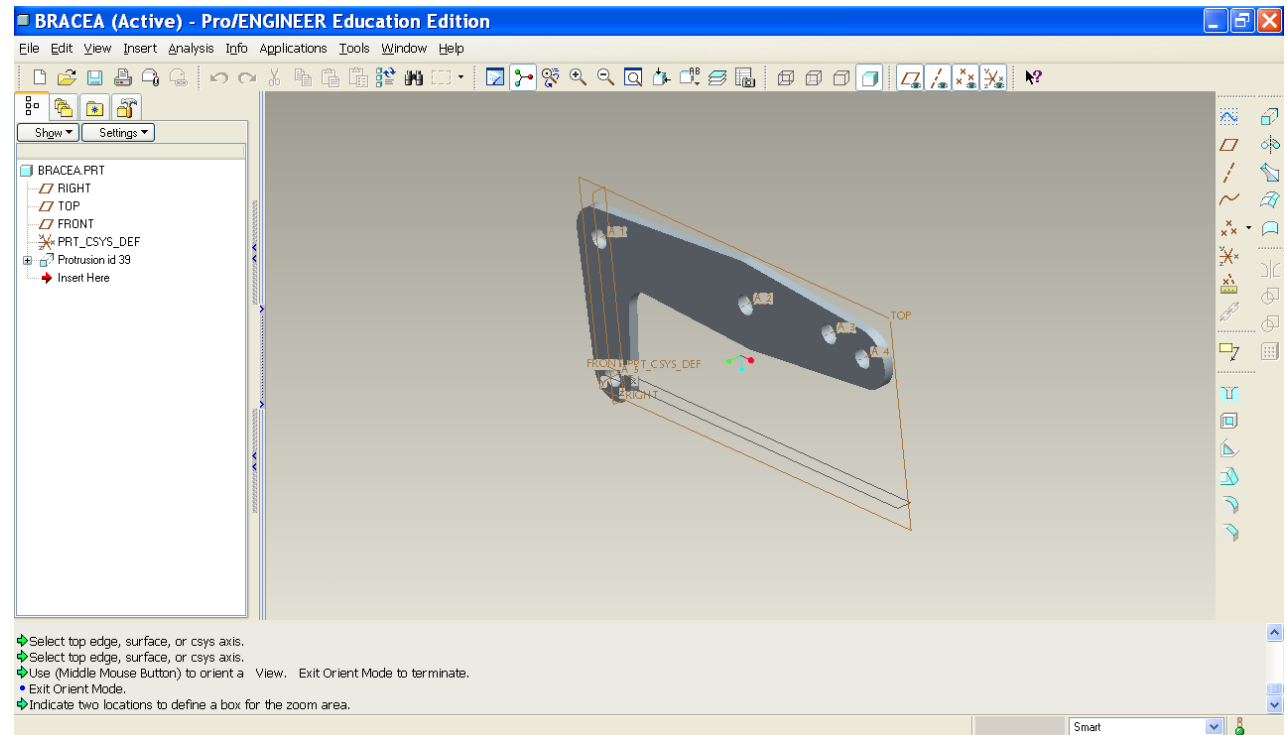
Rotation

Zooming
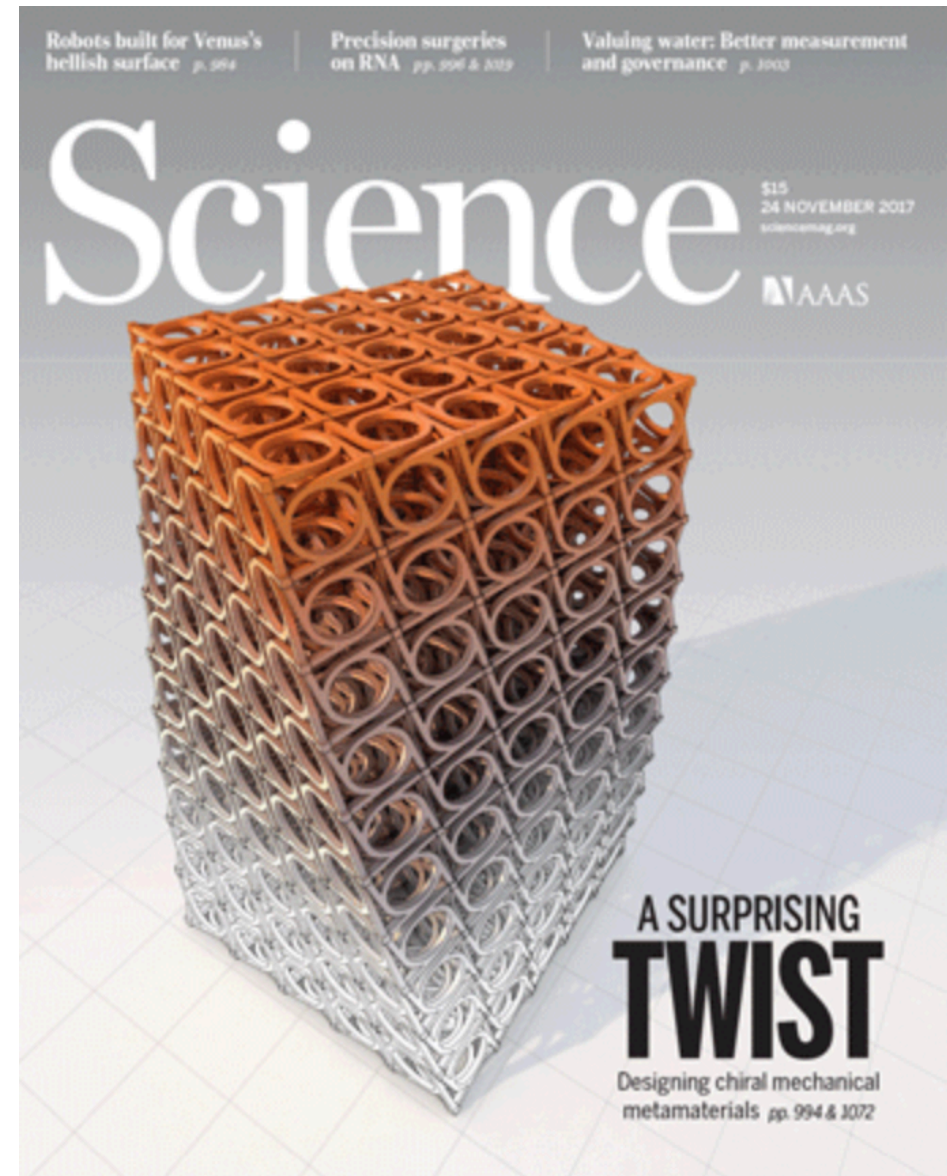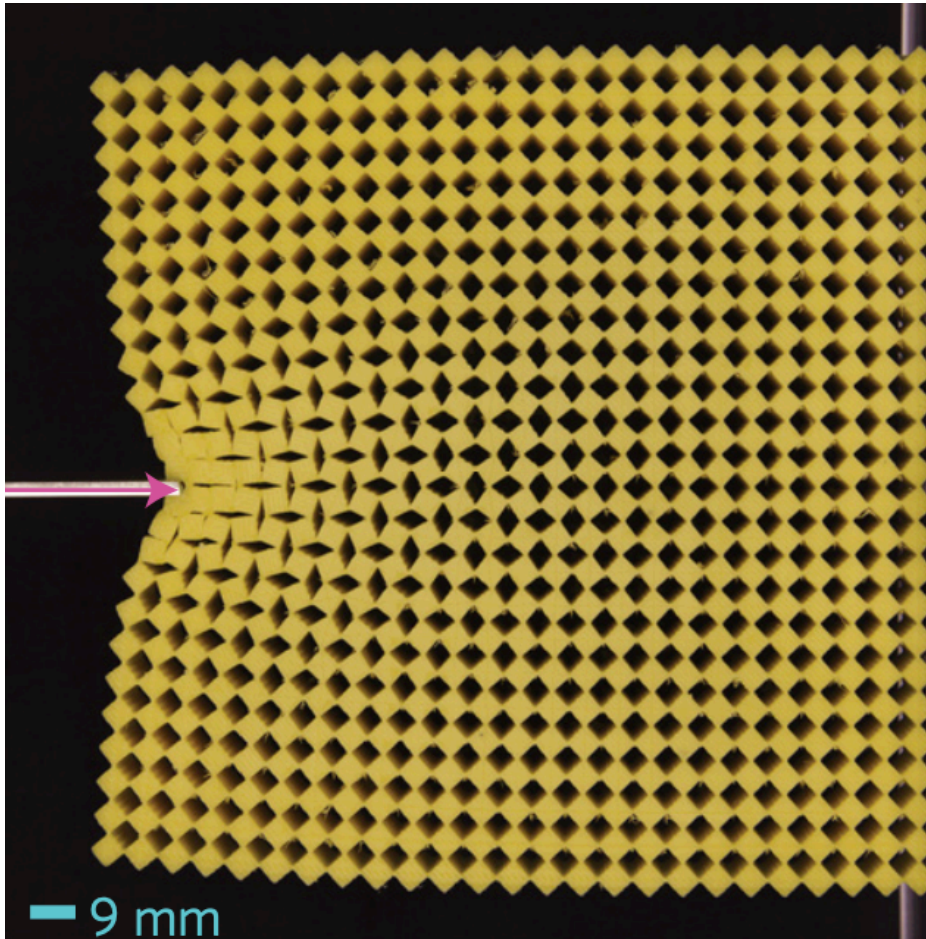
3-D transformation (rotation)

Hand written notes

A more compelling motivation

- Ok, so we have seen the math.
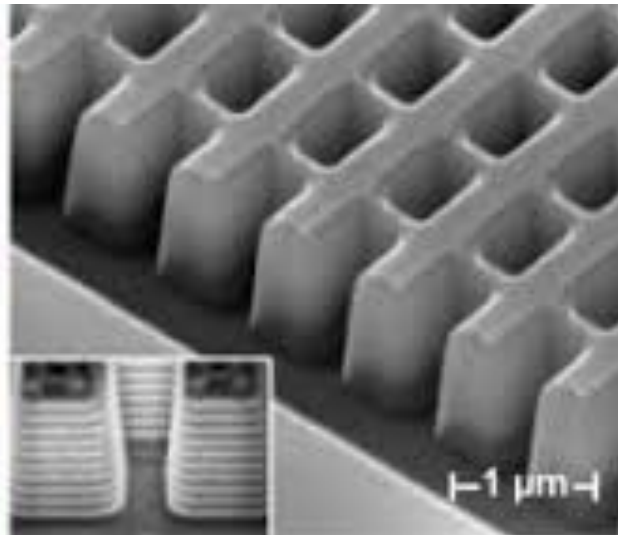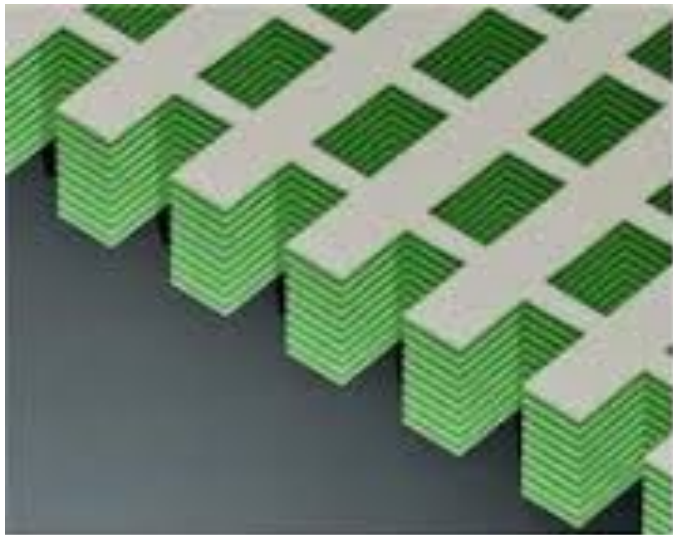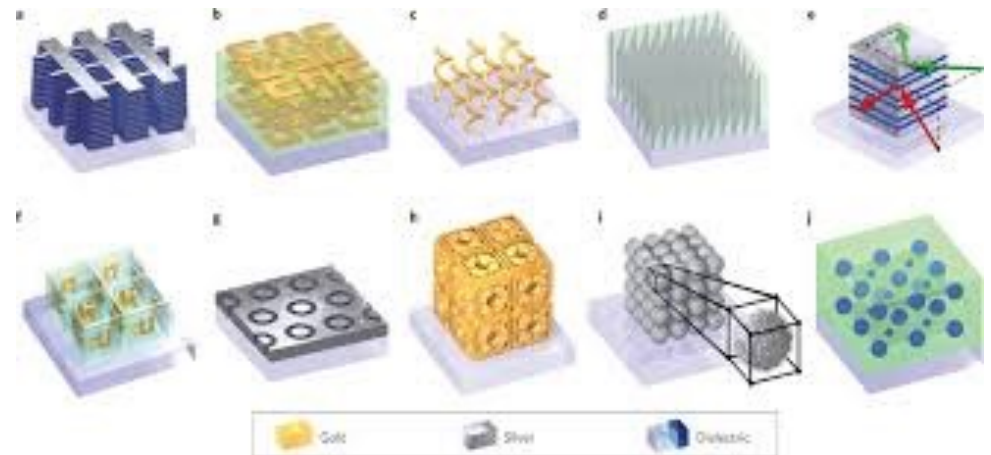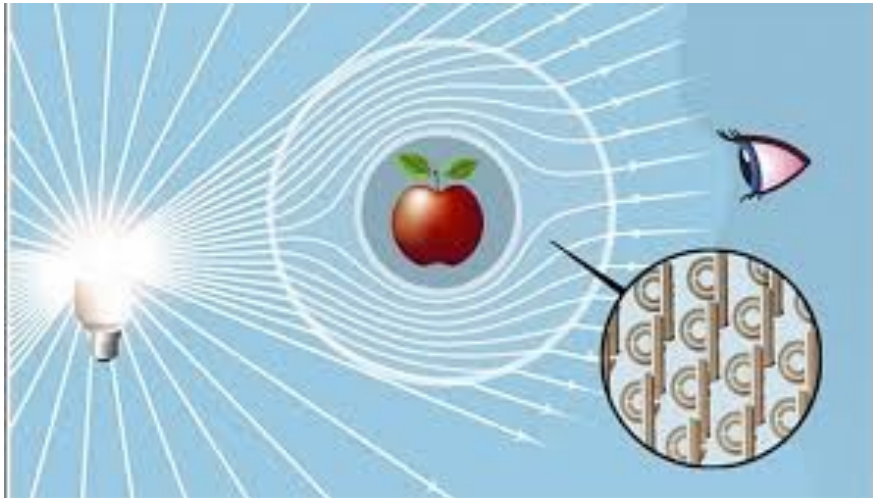 - You may be asking yourself — why do I need to know this!

Metamaterials: a case study

- Mechanical metamaterials

Metamaterials: a case study

Optical metamaterials: Real-life cloaking devices made from arrays of periodic or quasi-periods structures

Metamaterials: a case study
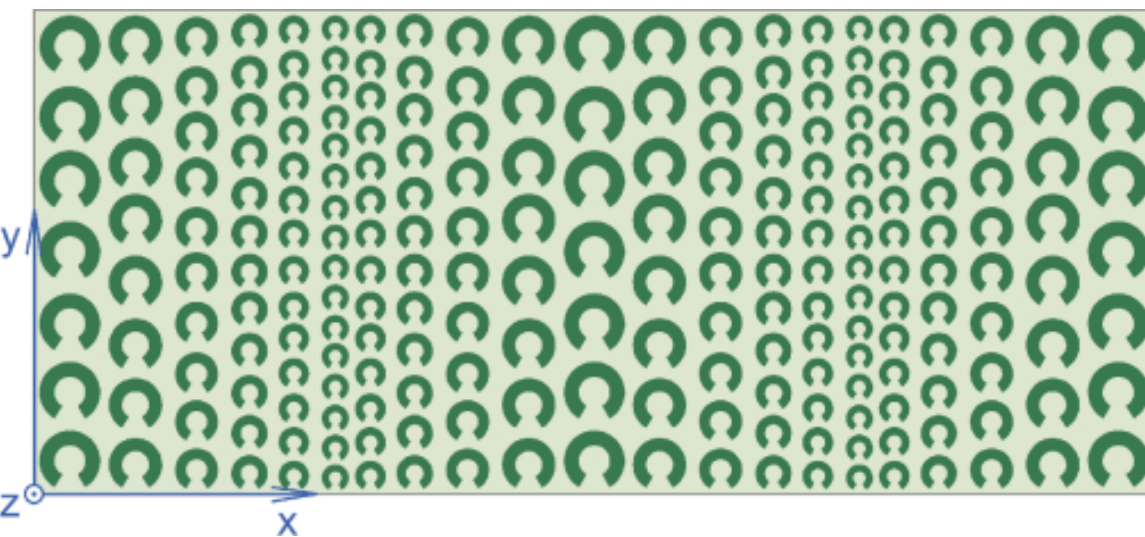
19 August 2013

Exact analytical solution for fields in gradient index metamaterials with different loss factors in negative and positive refractive index segments

Mariana Dalarsson; Martin Norgren; Tatjana Asenov; Nebojsa Doncov; Zoran Jaksic;

Author Affiliations +

We may want to generate OM's with complex periodic shapes that have gradients or periodicity in scale/rotation.

How to design large-scale, parameterized patterns?

- In CAD software
  - Define base shape
  - Apply a series of rotation and array operations (array operation copies, translates, and rotates)
  - Repeat, repeat, repeat, as many times as needed dependent on the shape variation across the metamaterial pattern.
- Using mathematical transformations (in Matlab)
  - Define base shape
  - In a loop apply your operations parametrically
  - Culminates in a list of (x,y) points corresponding to your geometry
  - Export to a text file and import to CAD software (if needed)

For next Tuesday

- Download and install Autodesk Fusion 360 onto your computer

- HW 1 will be posted this evening, due Midnight next Thursday