# CS 402:
# Computer Graphics

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**Professor of Computer Science**

**Faculty of Computer and Artificial Intelligence**

**Misr University for Science and Technology**

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# CS 402: Computer Graphics

# Lecture Note 01

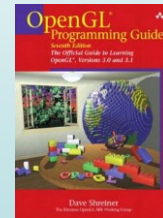## Course outline & Organization
## and
## Chapter 1: Introduction

# CS 402: Computer Graphics

- **Lecturer: Prof. Dr. Mostafa Gadal-Haqq**

- **Text Book: Computer Graphics with OpenGL, 3rd**

    » **By: Hearn and Baker**

- **Lab book: OpenGL Programmer Guide, 3rd ed.**

    » **By: Woo *et. al.***

# CS 402: Computer Graphics

**Prerequisites:**

- **CS102 / CS 201: C++ Programming**

- **CS 212: Data Structure**

- **Math 241: Linear Algebra**

    **Refresh your knowledge**

## CS 402: Computer Graphics

**Course Assessment:**

- **Attendance & Contributions**     **10 points**
- **Assignments (Lectures, Labs)**     **10 points**
- **Quiz 1 (Written)**     **20 points**
- **Quiz 2 (Online)**     **20 points**
- **Lab Final Test**     **30 points**
- **Final Exam**     **60 points**

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**150 points**

## CS 402: Computer Graphics

- **Regulations:**

  – **Students should attend at least (75%) of the classes**

    • **Four-absence with no official excuses will yield course failure**

  – **Late assignments delivery is not permitted**

  – **Any misconduct will yield course failure**

# CS 402: Computer Graphics

- **How to pass this (and any) course:**

    – **Don't accumulate**

    – **Do it yourself**

    – **Ask for help**

# CS 402: Computer Graphics

- **Course Objectives:**

    – **Computer graphics has become a crucial component in user interfaces, data visualization, television commercials, motion pictures. It includes almost everything on computers monitor. The objective of this course is to teach the principles, techniques, and tools of computer graphics.**

# CS 402: Computer Graphics

- **Course Outcomes (ILOs).**
- **Upon completing this course, students should be able to :**
  - **Understand the foundations of computer graphics.**
  - **Understand the computational geometry and its use in our life.**
  - **Understand the triangulation problem.**
  - **Recognizing raster and vector graphics and rasterization of graphics primitives**
  - **Differentiate between different graphics systems.**
  - **Implement computer graphics algorithms.**
  - **Program basic concepts using OpenGL Programming language.**
  - **Implement spatial transformations in graphics.**

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## Related website:

- **SIGGRAPH. (http://www.siggraph.org)**

- **OpenGL (http://www.opengl.org)**

- **C++ prog.  (http://www.cplusplus.com)**

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# CS 402 : Computer Graphics

## Lecture1: Overview

–**What is Computer Graphics**

–**Graphics Software**

• **Materials:** Hearn & Baker - **Chapter 1 (Skim reading )**
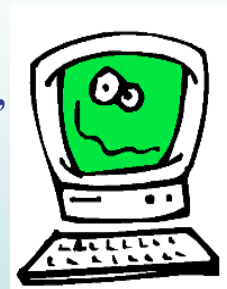
# Computer Graphics

**What computers do?**
"**process, transform, and communicate information (data)**"

**Computer Graphics is...**
"**the technology for *presenting* information on computer output devices**"

# CS 402 : Computer Graphics

## what is this course really about?

| *Its about...* | *Not about!* |
|---|---|
| •Graphics programming algorithms | •Paint and Imaging packages (Adobe Photoshop) |
| •Color and human vision | •CAD packages (AutoCAD) |
| •Graphical interface design and programming | •Rendering packages (Lightscape) |
| •Applied geometry and modeling | •Modeling packages (3D Studio MAX) |
| •Applied numerical computing | •Animation packages (Digimation) |
| •Graphics APIs (OpenGL) ? | |

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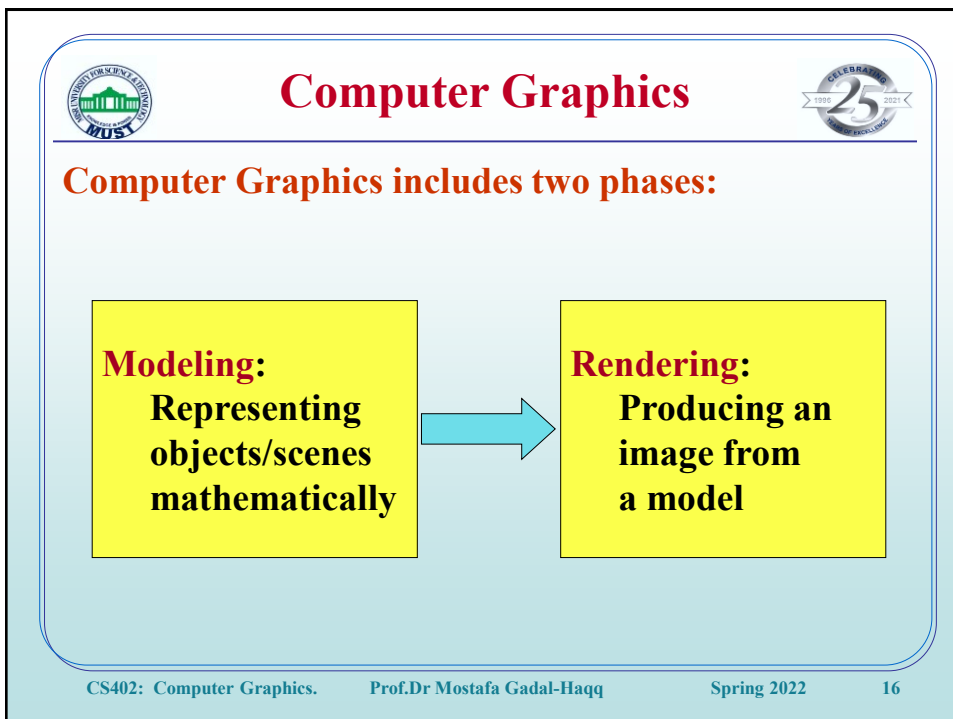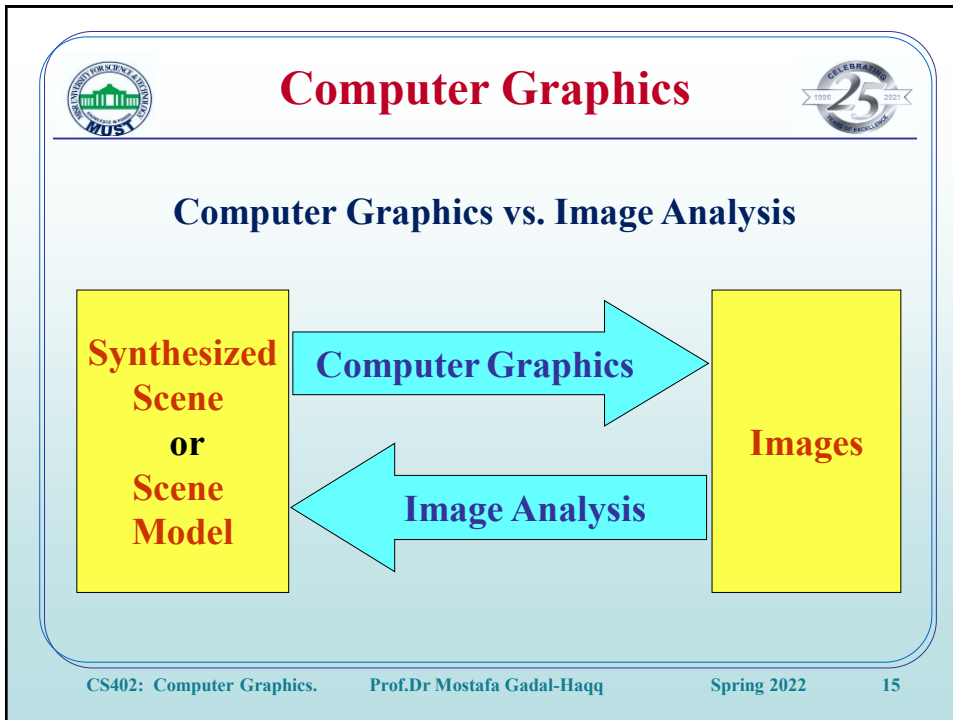
# Computer Graphics

**Definition:**

"Computer graphics is concerned with all aspects of producing pictures or images using a computer"

That is, Computer Graphics is the art of:

Creation, storage, manipulation, and display models of scenes using the computer.
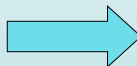
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# Computer Graphics

## Computer Graphics vs. Image Analysis

| Synthesized Scene or Scene Model | → Computer Graphics → | Images |

**Image Analysis** ←

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# Computer Graphics

**Computer Graphics includes two phases:**

**Modeling:** Representing objects/scenes mathematically

→

**Rendering:** Producing an image from a model

# Computer Graphics

## Computer Graphics includes two phases:

### Modeling

### Rendering

# Computer Graphics Applications

## Graphical User Interfaces (GUIs)

Computer graphics is an integral
part of every day computing.
No where is this fact more evident
than the modern computer interface
design.

Graphical elements such as windows,
cursors, menus, and icons are so
common place it is difficult to
imagine computing without them.
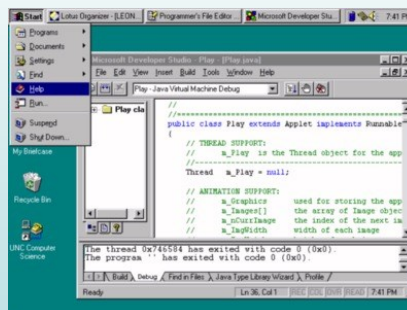
# Computer Graphics Applications

## Computer Aided Design

Computer graphics has had a dramatic impact on the design process. Today, most mechanical and electronic designs are executed entirely on computer. Increasingly, architectural and product designs are also migrating to the computer. CAD designs also play a key role in a wide range of processes from the design of tooling fixtures to manufacturing.

CAD has had the follow impact on computer graphics.

• Drives the high-end of the HW market

• Integration of computing and display resources

• Reduced design cycles (faster systems sooner)
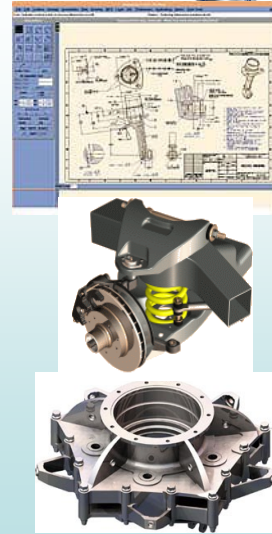
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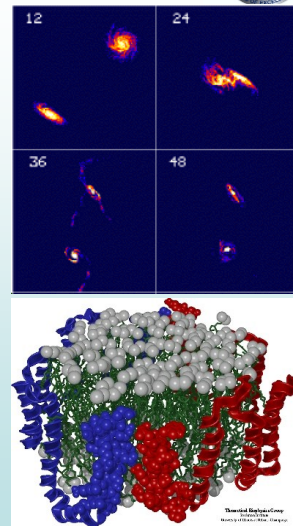
# Computer Graphics Applications

## Scientific Visualization

Computer graphics makes vast quantities of data accessible. Numerical simulations frequently produce millions of data values. Similarly, satellite-based sensors amass data at rates beyond our abilities to interpret them by any other means than visually.

Mathematicians use computer graphics to explore abstract and high-dimensional functions and spaces. Physicists can use computer graphics to transcend the limits of scale. With it they can explore both microscopic and macroscopic worlds.

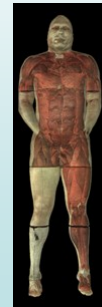CS402: Computer Graphics.        Prof.Dr Mostafa Gadal-Haqq        Spring 2022        20

# Computer Graphics Applications

## Medical Imaging

**Today, it can honestly be said that computer graphics plays a significant role in saving lives. The range of application spans from tools for teaching and diagnosis, all the way to treatment.**

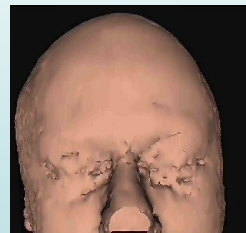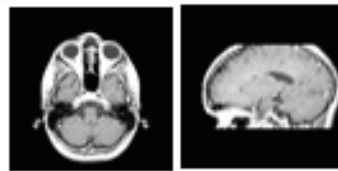**Computer graphics is a *tool* in medical applications.**

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# Computer Graphics Applications

## Medical Imaging

**How medical applications influence computer graphics technology?**

1. **New data representations and modalities**
2. **Drive issues of precision and correctness**
3. **Focus on presentation and interpretation of data**
4. **Construction of models from acquired data**

# Computer Graphics Applications

**Talking about movies is okay in Computer Graphics!**

If you can imagine it, it can be done with computer graphics. More and more of these images exist Only within the memory of a computer. There seems to be no end in sight for this trend.



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# Computer Graphics Applications

Also **Games** are okay here!

**Games are an important driving force in computer graphics.**

**How the game's industry impacts computer graphics?**

- **Focus on interactivity**
- **Cost-effective solutions**
- **Avoiding computation and other tricks**



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# Graphics Software

# Graphics Software

## Overview of a SW Graphics application
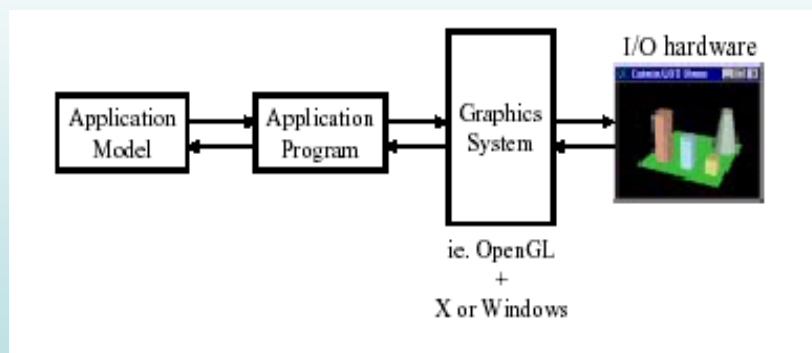
# Next time

## Next Lecture:
### Discuss Graphics Displays.

## Next Lab:
### Discuss OpenGL and GLUT.