



**uff** Universidade  
Federal  
Fluminense

# Computer Graphics for Engineering



**numsim**

Numerical simulation  
in technical sciences

## A Brief Introduction

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Graz, Austria  
June 2014

# **What is Computer Graphics?**

# **What is Computer Graphics?**

“... it includes almost everything  
on computers that is not text or sound.”

(Source: Cornell University Program of Computer Graphics)

# Computer Graphics



Data

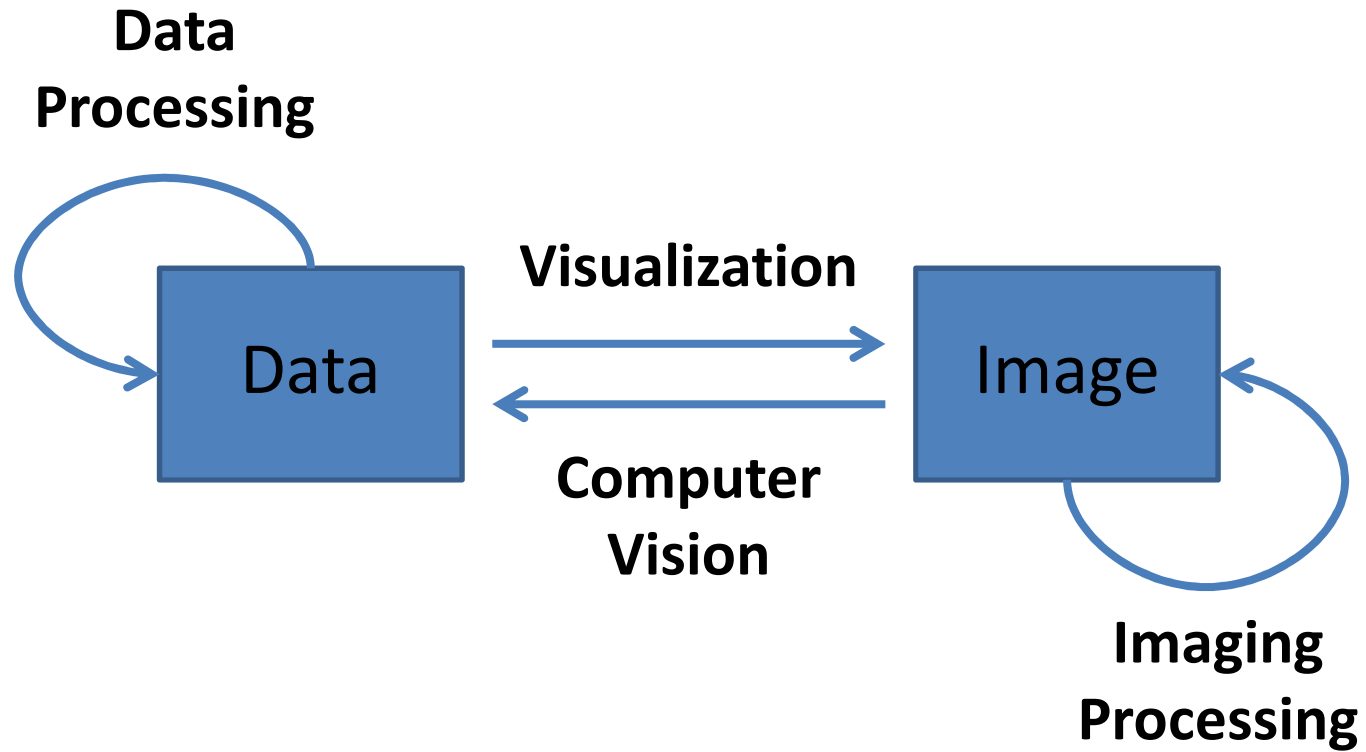


Image

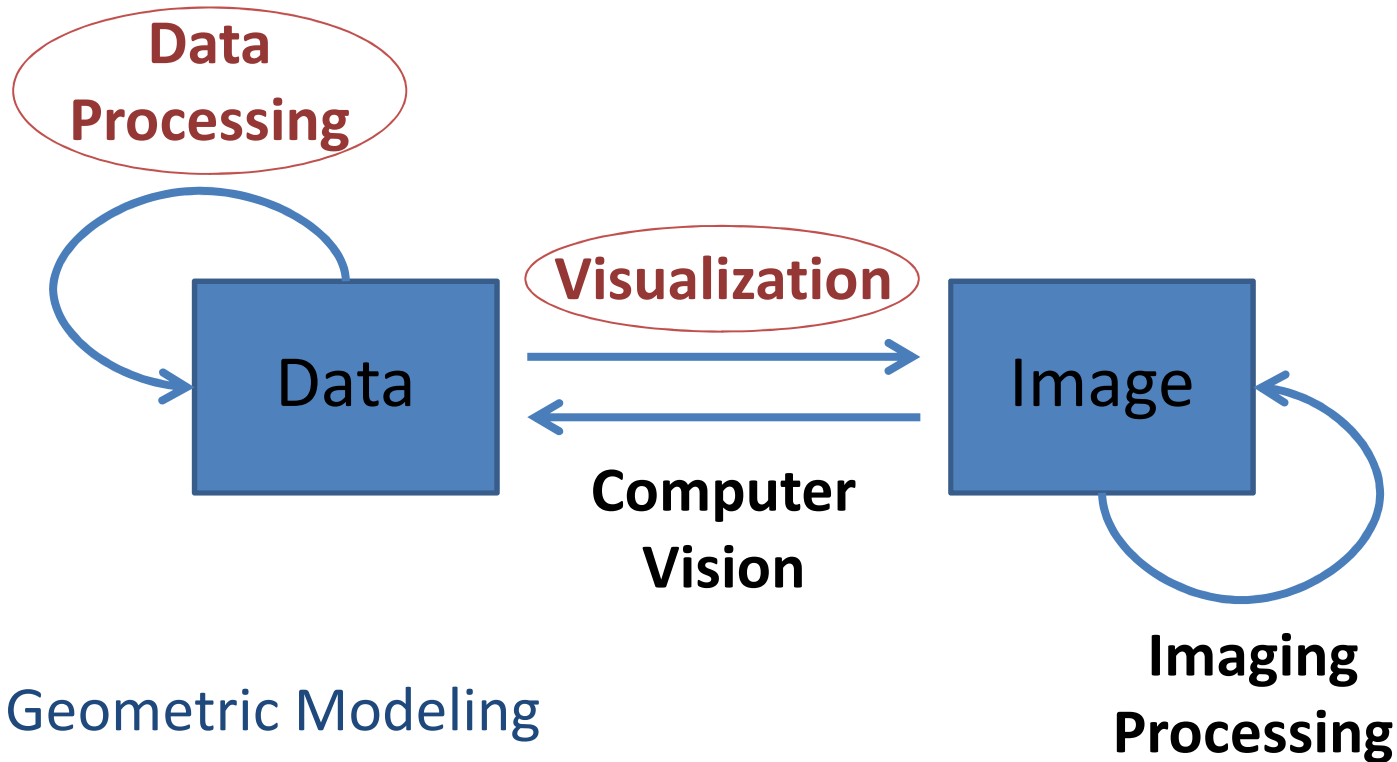
# Computer Graphics



# Computer Graphics

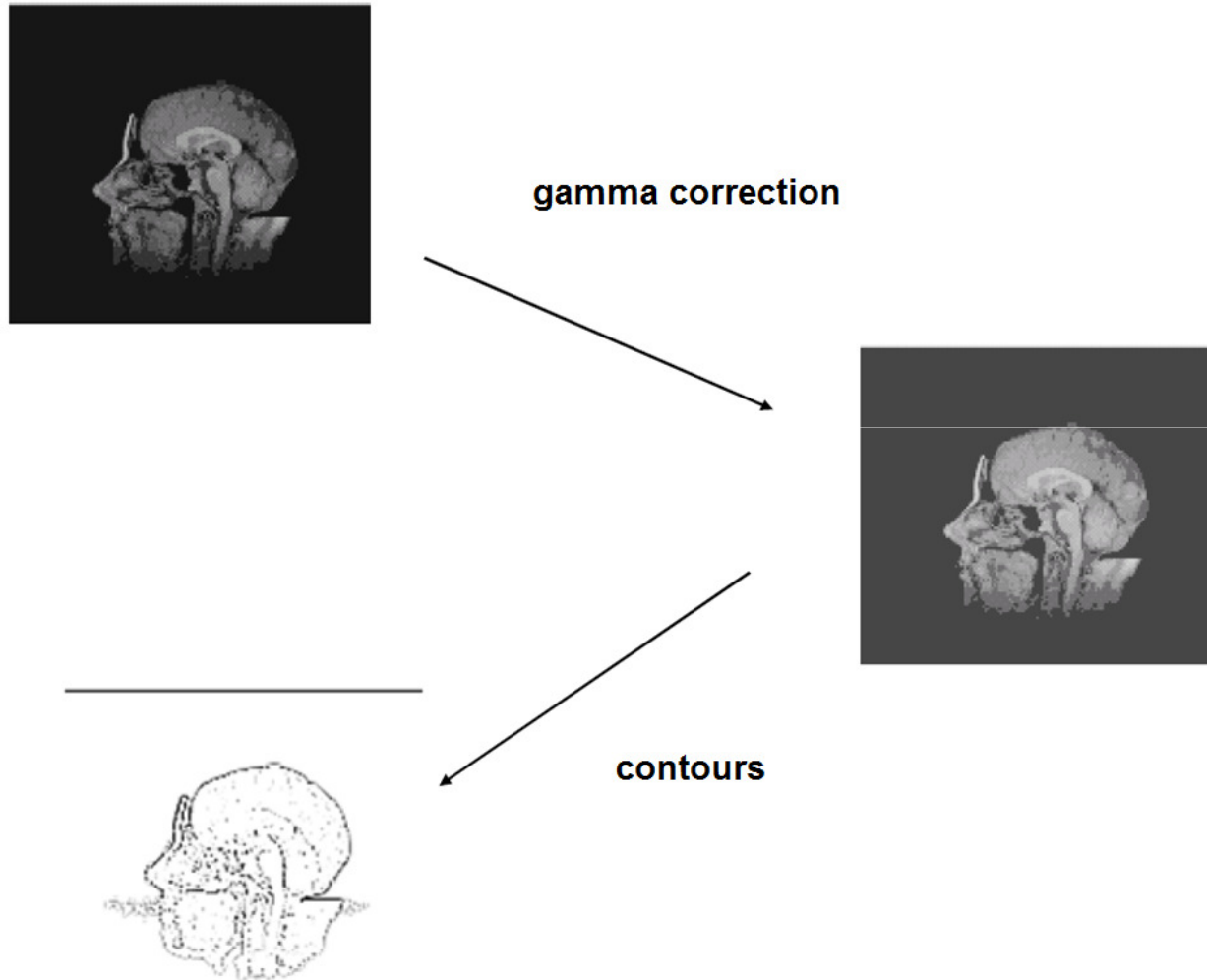


# Computer Graphics



- Geometric Modeling
- Mesh Generation
- Computational Geometry
- Visualization Techniques (Post-processing)

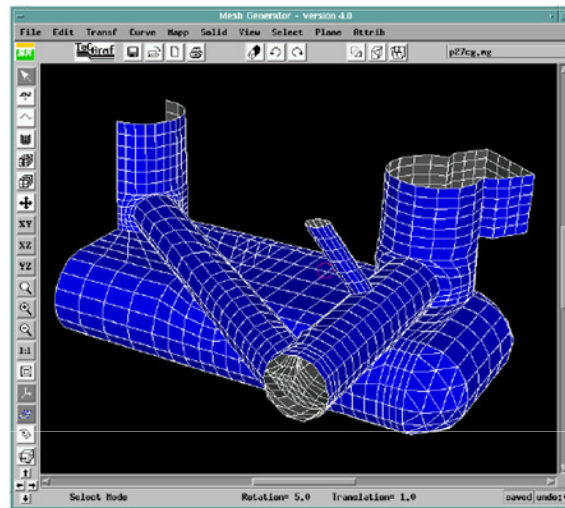
# Imaging Processing



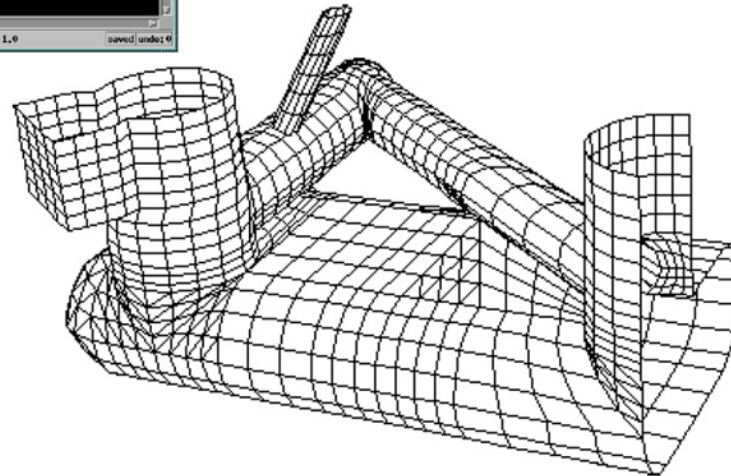
(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)



# Data Processing and Visualization



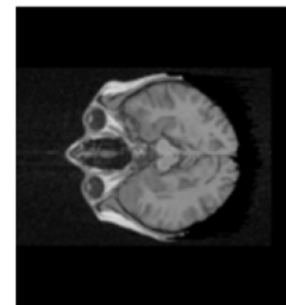
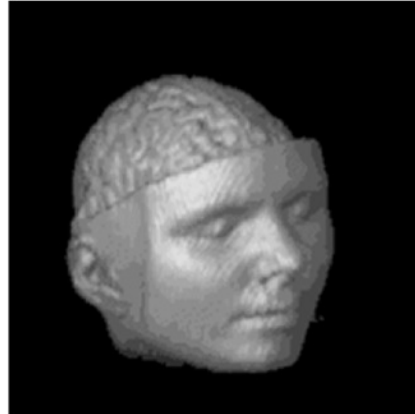
Engineering Design



(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)

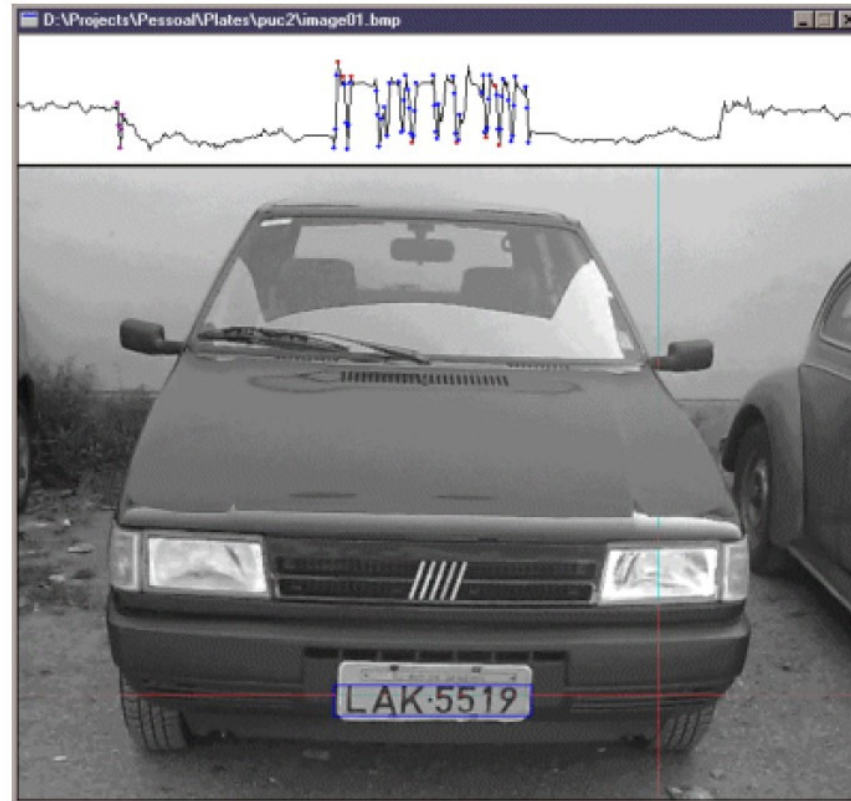
# Visualization

Medicine



(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)

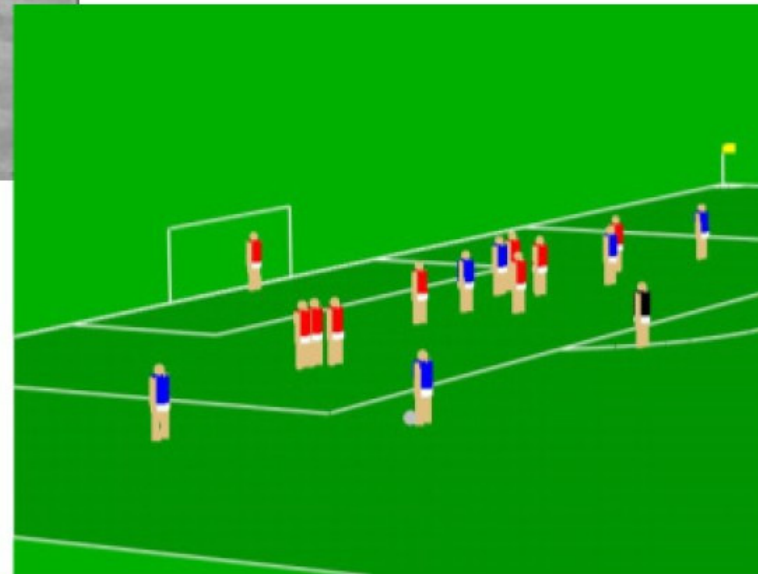
# Computer Vision



↙  
LAK 5519

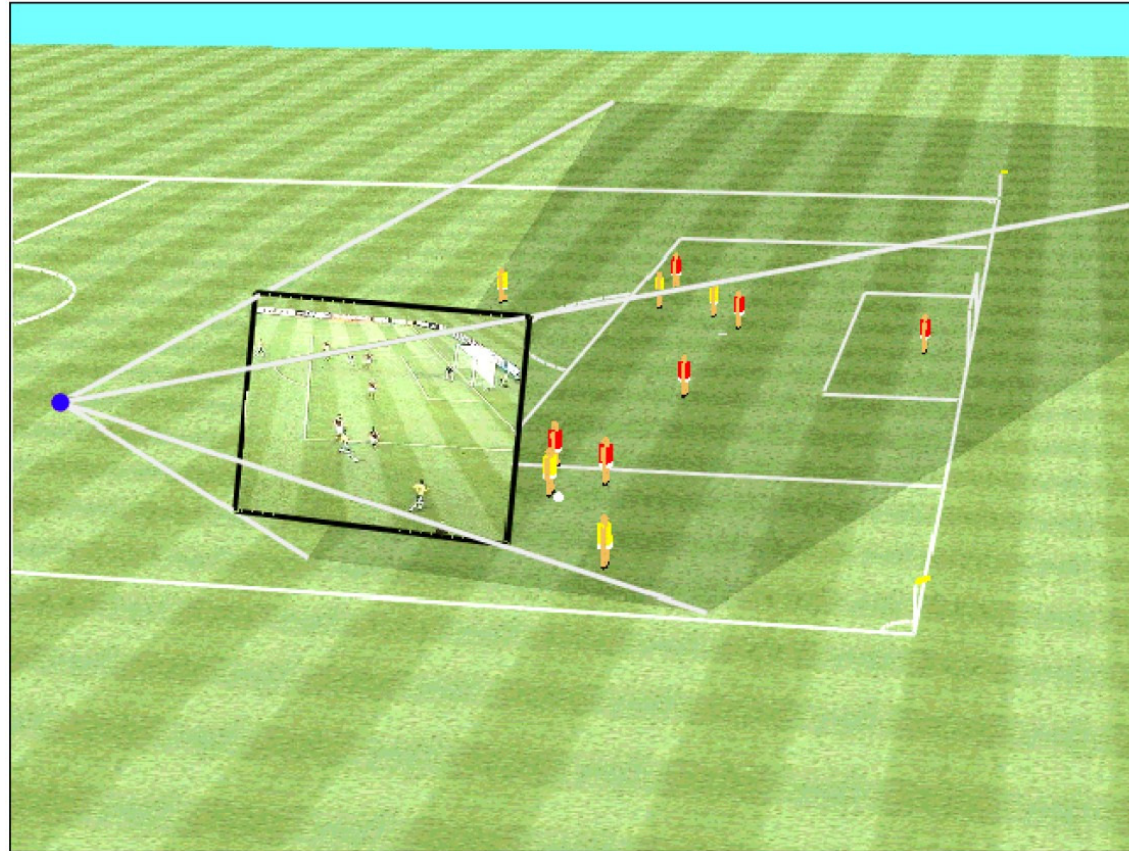
(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)

# Computer Vision



(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)

# Computer Vision



<http://www.tecgraf.puc-rio.br/juizvirtual>

<http://www.visgraf.impa.br/juizvirtual>

(Source: Prof. Marcelo Gattass, Lecture Notes on Computer Graphics, Department of Informatics at PUC-Rio)

# Computer Graphics Professionals

## Users:

They use software to produce drawings and images

## Customizers:

They adapt existing software

## App Programmers:

They develop AutoCAD, Corel, ...

## Developers of Tools:

They develop OpenGL, DirectX, ...

**Why are we interested in this subject?**

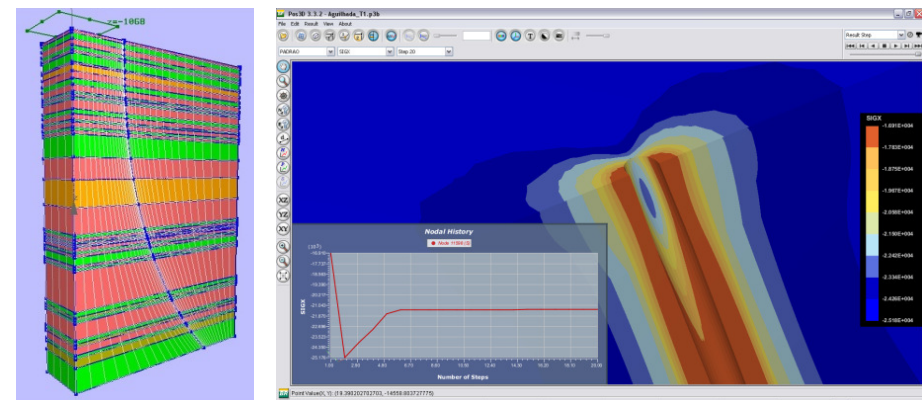
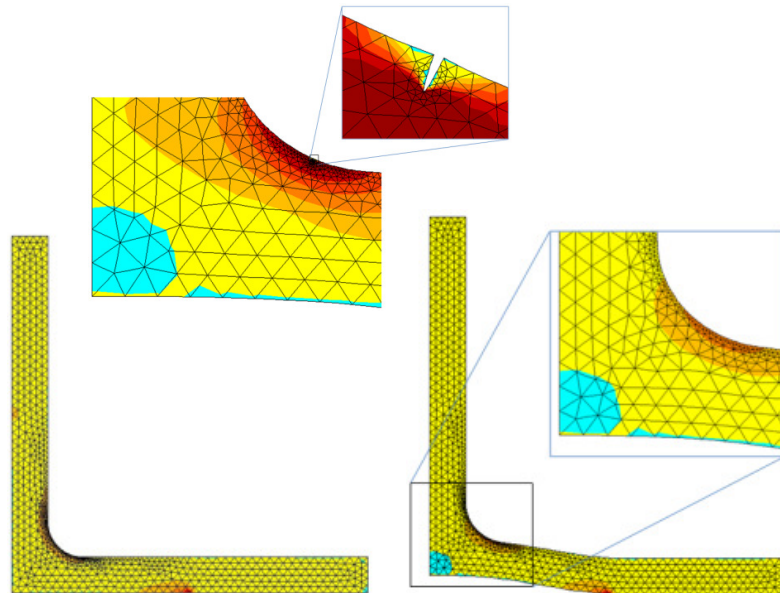
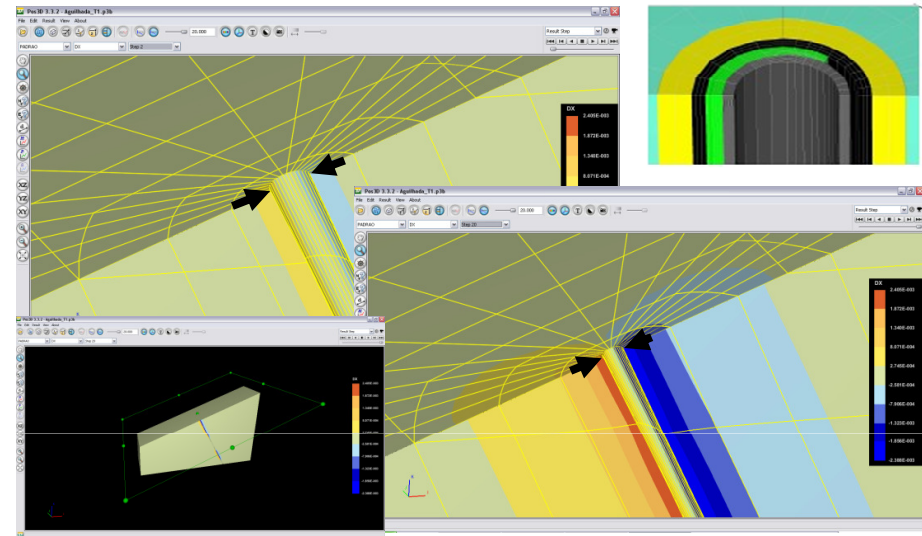
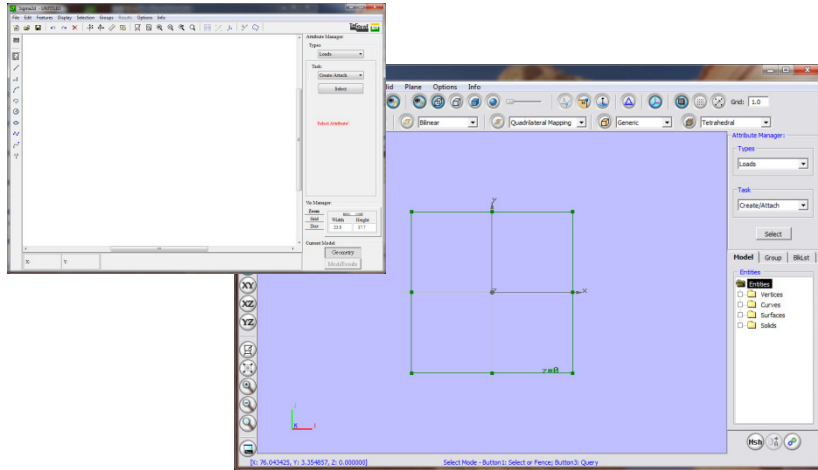
**Why are we interested in this subject?**

Numerical Simulations

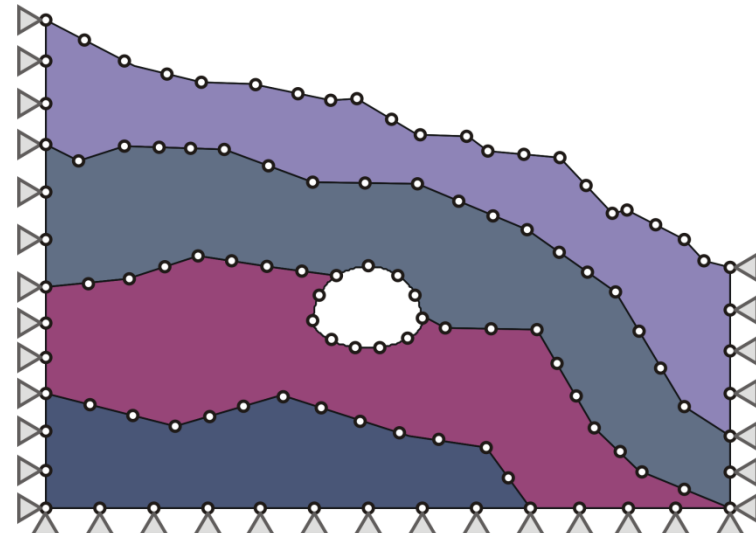
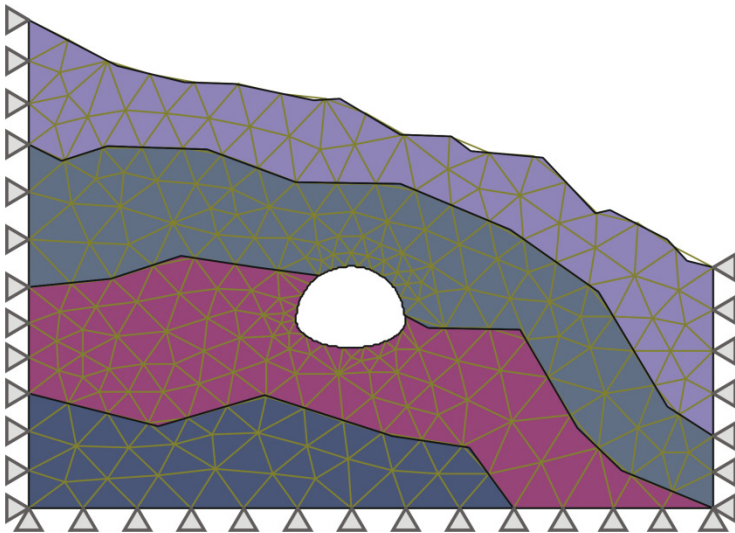
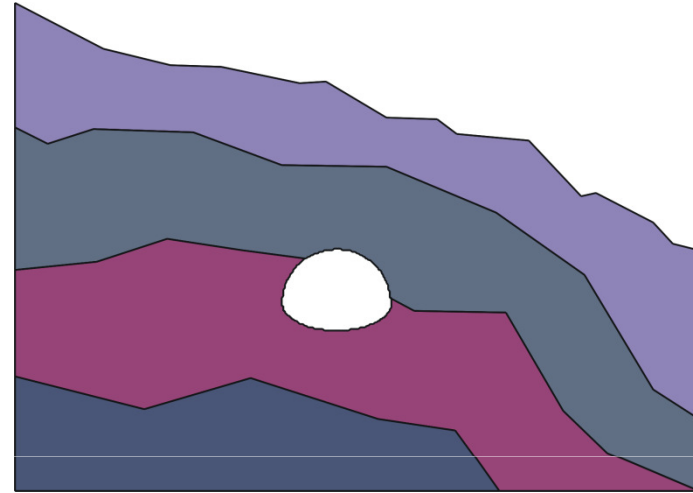
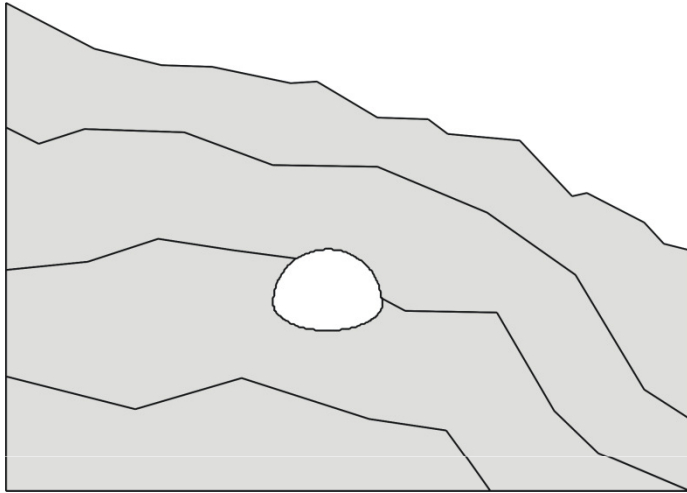
Computational Mechanics



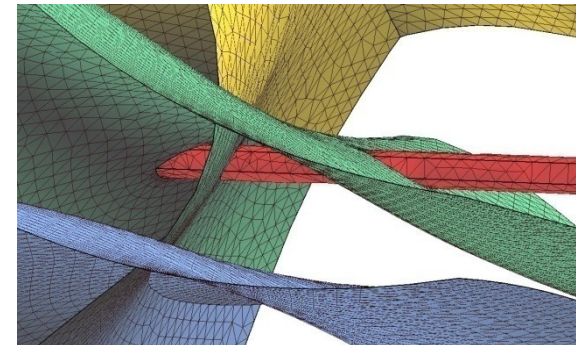
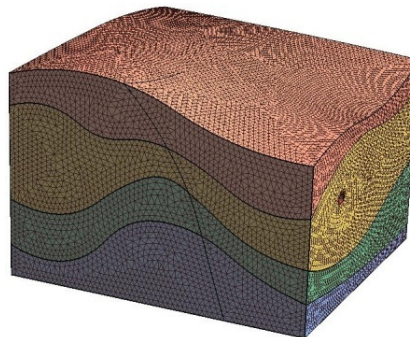
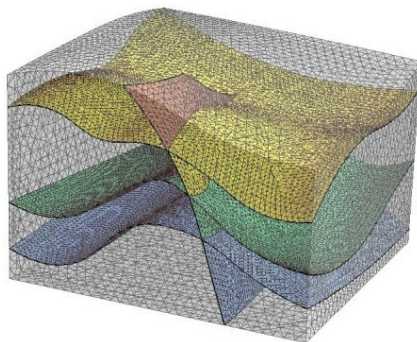
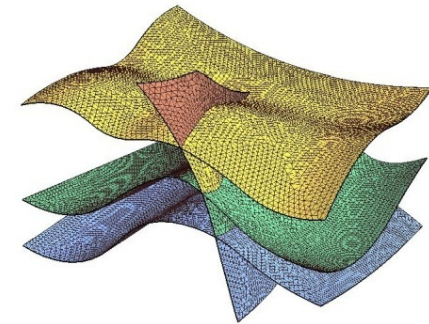
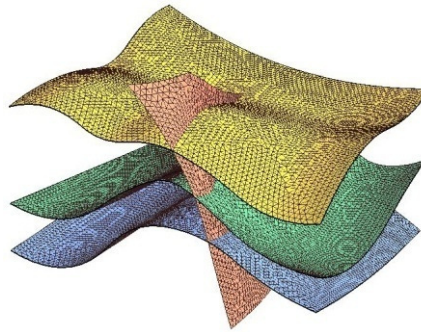
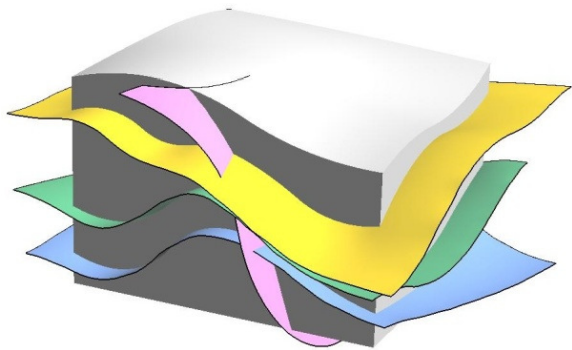
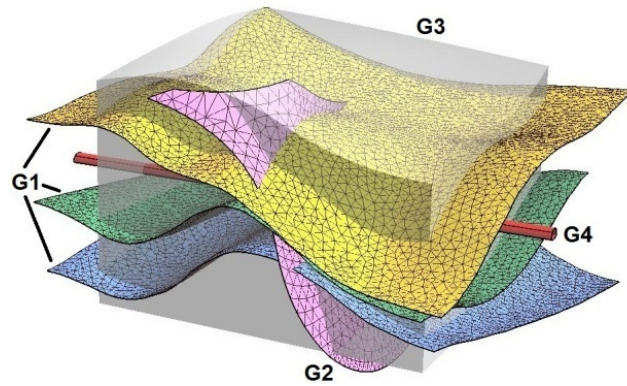
# Interested in...



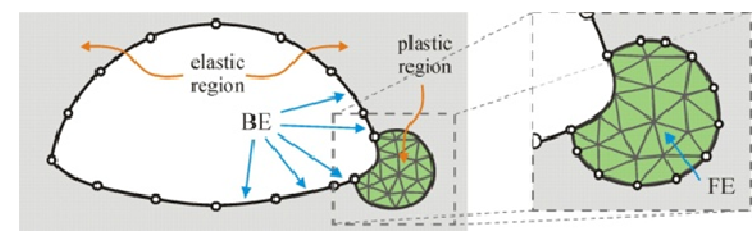
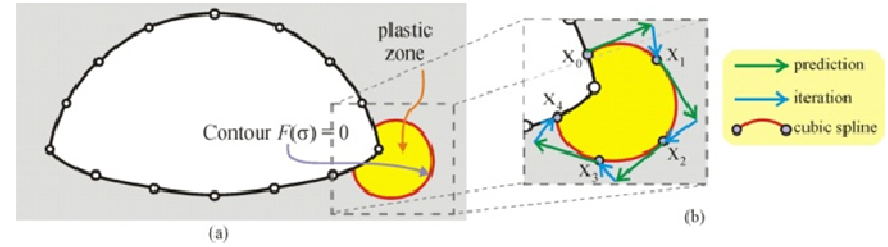
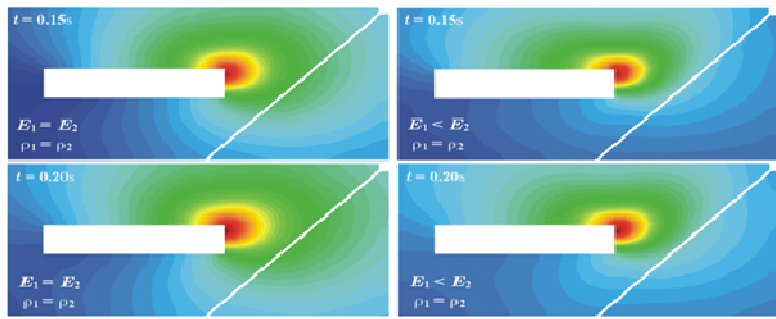
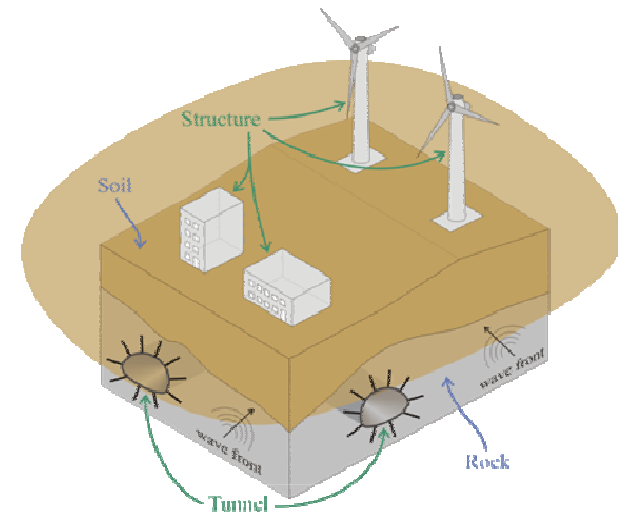
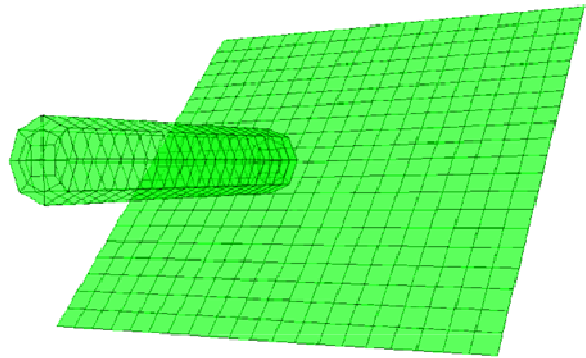
# Interested in...



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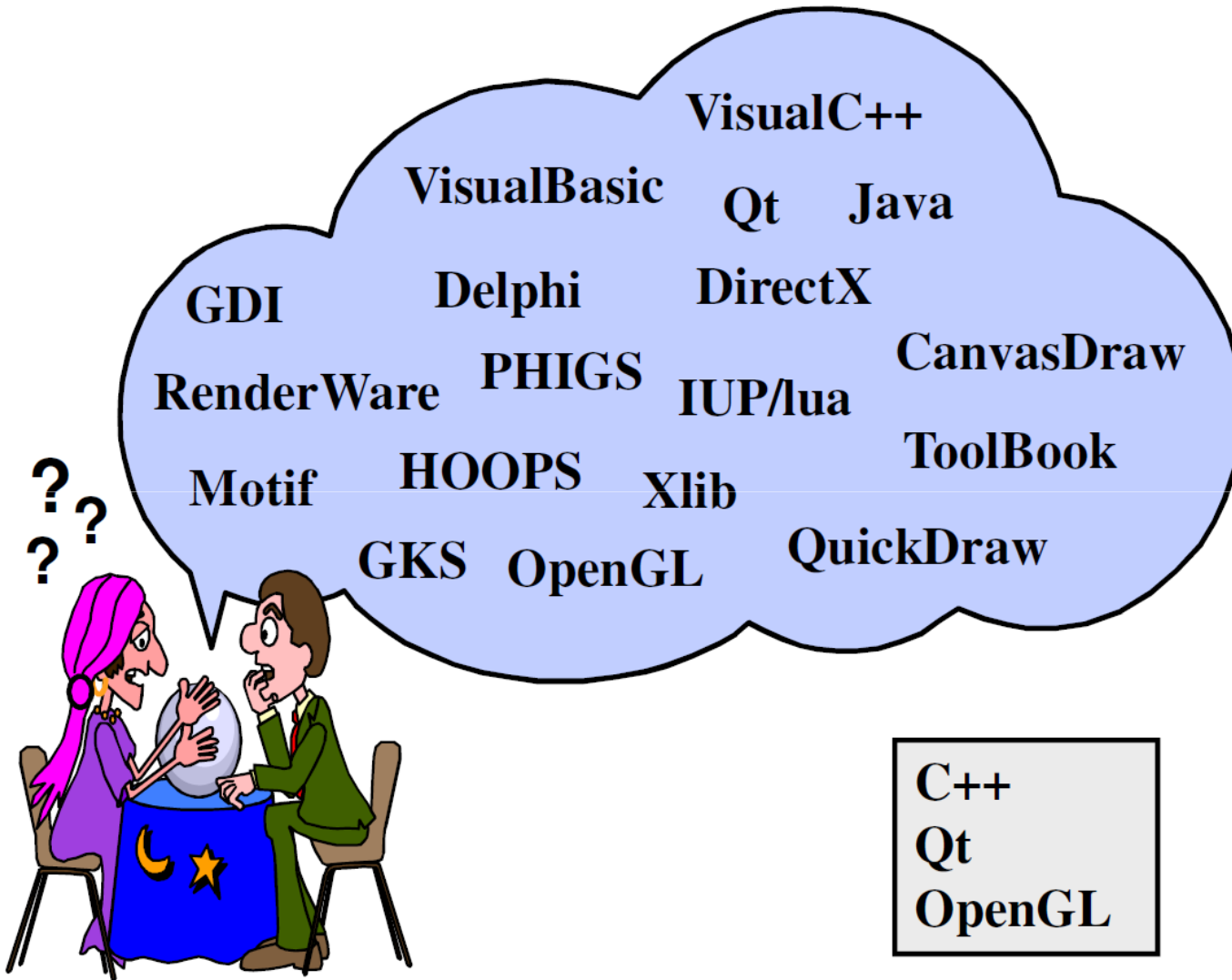


# Interested in...



# **How to Develop in Computer Graphics?**

## IDEs, Compilers, Libraries and Tools



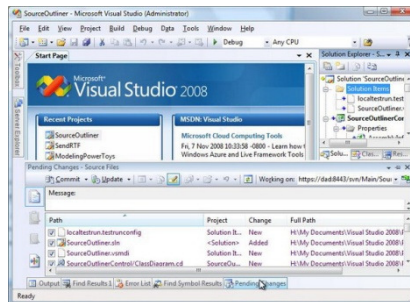
# Development Environment

C++



# Development Environment

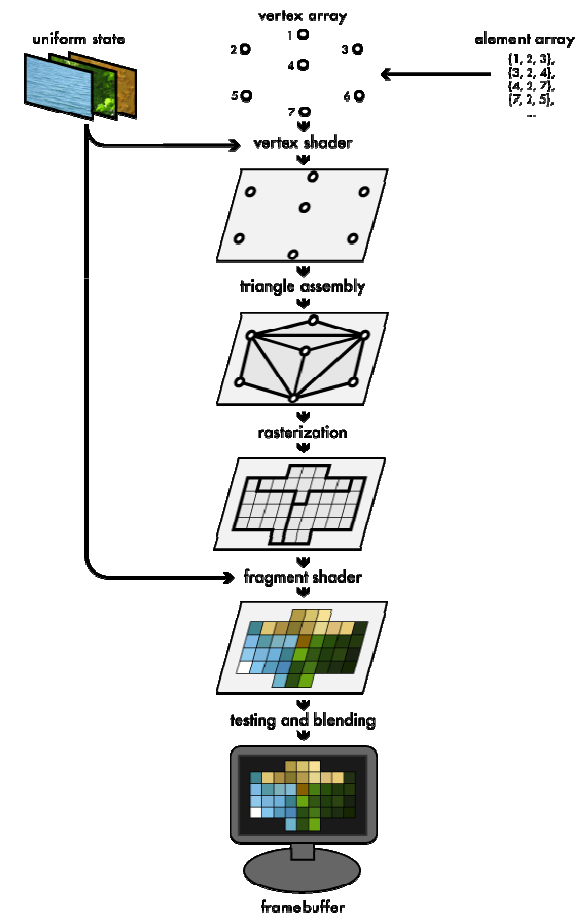
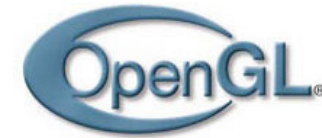
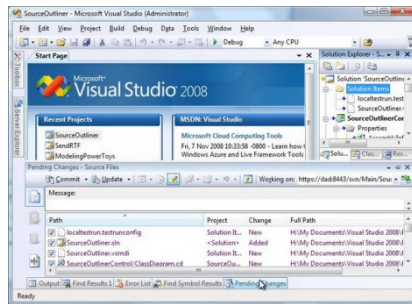
## C++





# Development Environment

## C++



# History of Tools

## Graphics:

1978-core

1985-GKS

1988-PHIGS

1990-PEX

1991-GL

1993-OpenGL

1996-Direct 3D

## OS and UIS:

1984-Macintosh

1987-XWindow v.11

1988-Motif

1990-Windows 3.0

1993-Visual Basic v.3

1995-Delphi

1995-Windows 95

1996-Java

1999-Windows NT

...

2008-Qt



**Questions?**