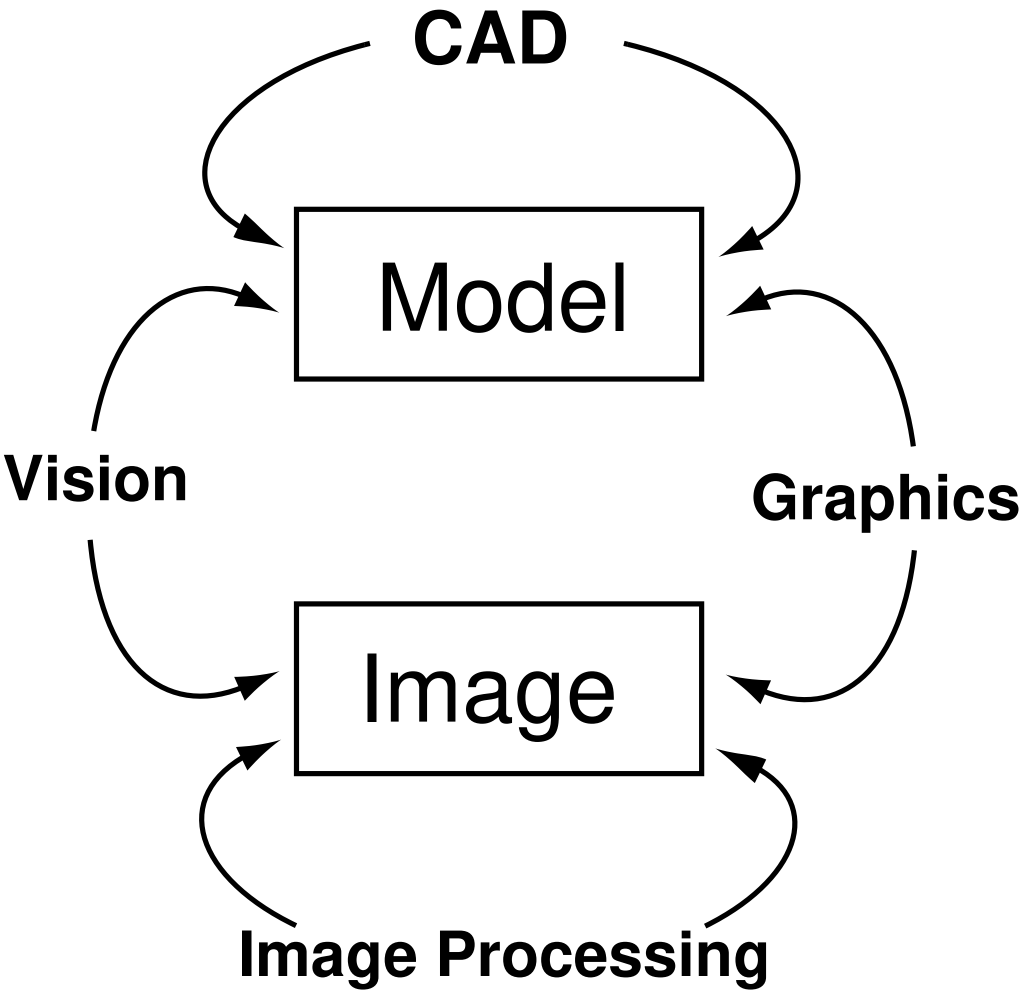
Introduction to Computer Graphics

Luiz Velho

IMPA
Instituto de Matematica Pura e Aplicada
Rio de Janeiro, Brazil

Context



Applications

- Types
  - Data Visualization
  - Man-Machine Interface
  - Computer Aided Design
- Examples
  - Scientific Visualization
  - Multimedia
  - Industrial Design

Scope

- What we will study
  - 3D Graphics
  - Synthetic Images
- Areas of Application
  - Entertainment
    - Television
    - Film
    - Games
  - CAD / CAM
    - Engineering
    - Architecture
    - Design
  - Scientific Visualization
    - Medicine
    - Biology
    - Mathematics

Scope

- What we will not cover
  - 2D Graphics
  - Real Images
  - Human-Computer Interaction
- Areas of Applications
  - Electronic Publishing
    - Illustration
    - Paint Systems
    - Page Layout
  - Image Processing
    - Video Effects
    - Pattern Recognition
  - Interface Design
    - Window Systems
    - Toolkits
    - UIMS

Scope

- Other Issues
  - Systems Architecture
  - Graphic Standards
  - 3D Animation

Objectives

- Goals
  - Broad View of the Area
  - Concepts and Relations
  - Main Problems
  - Solid Base for Future Work
- Intended Audience
  - Future Researchers
  - Systems Designers
  - Graphics Programmers
- Background
  - Computer Programming
  - Linear Algebra
  - Calculus

Levels of Abstraction

- Universes Paradigm

$$\boxed{P} \to \boxed{M} \to \boxed{R} \to \boxed{I}$$

- Problems
  - Define the Elements of M
  - Study the Relation between P and M
  - Define Representations Schemes
  - Study Conversion in R
  - Define Implementation Methods
  - Compare Strategies in I

Course Structure

- Preliminary Notions
  - Graphic Devices
  - Fundamentals of Color
  - Digital Image
- Geometric Modeling
  - Representation Schemes
  - Transformations
- Visualization
  - Camera and Clipping
  - Rasterization and Visible Surfaces
- Illumination
  - Materials and Illumination Models
  - Shading and Mapping
- System's Issues

Bibliography

- General
  - Foley / Newman / Watt / Slater
- Modeling
  - Farin / Mantilla / Hoffman / K B's
- Visualization
  - Glassner / Hall
- Image
  - Gonzales / Wolberg
- Implementation
  - Harrington / Gems
- Others
  - Samet / Rogers

Administrivia

- Classes
- Exercises
- Programming
- Grading