

3-Dimensional Image Science

Special Subjects
Elective 2 credit

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1. Course Description

Students will learn the followings in this course,

- (1) Physical and mathematical principles for 3D image treatise (physical optics, theory of image reconstruction, etc.)
- (2) Basics of computational implementation of above theories
- (3) Foundation of computational tomography.

2. Course Objectives

In this course we shall learn the physical and mathematical principles for treating 3D images and their computational implementation.

We aim to reach the comprehension of the fundamentals of computational tomography, which has numerous important applications including medical imaging of human internal organs.

3. Grading Policy

You will be graded by your submitted reports (50%) and final examination marks (50%).

Reports are returned with comments within 2 weeks after submission.

4. Textbook and Reference

Textbook

We will use the proprietary text provided by the lecturer.

Reference

A. C. Kak and M. Slaney "Principles of Computerized Tomographic Imaging" SIAM

5. Requirements(Assignments)

Read the assigned part of the text carefully and check the mathematical expressions by yourself (~3 hours).

6. Note

None.

7. Schedule

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| [1] | Introduction |
| [2] | Image processing 1 (Octave installation and test) |
| [3] | Image processing 2 (Basic coding in Octave) |
| [4] | Image processing 3 (Programming in Octave) |
| [5] | Physics of light 1 (Maxwell equations) |
| [6] | Physics of light 2 (Wave equation and theoretical models of light) |
| [7] | Theory of image formation 1 (Geometrical optics) |
| [8] | Theory of image formation 2 (Diffraction, reflection, absorption) |
| [9] | Theory of image formation 3 (Mechanics of image formation) |
| [10] | Fourier transform 1 (Continuous Fourier transform) |
| [11] | Fourier transform 2 (Multi-dimensional Fourier transform, convolution theorem) |
| [12] | Fourier transform 3 (Discrete Fourier transform) |
| [13] | Computational Tomography 1 (Physical principles) |
| [14] | Computational Tomography 2 (3D image reconstruction) |
| [15] | Computational Tomography 3 (Recent topics) |