

CIMET Advanced Colorimetry

2011-2012

Course name: Advanced Colorimetry

Course code: CIMET AC

Course level: Master

ECTS Credits: 5.00

Course instructors: Manuel Melgosa, Rafael Huertas (University of Granada) and Alain Trémeau (University of Saint-Etienne)

Education period (Dates): 2nd semester

Language of instruction: English

Prerequisite(s): Module "Color Science" (1st semester), Module "Human Vision and Computer Vision" (2nd semester)

Expected prior-knowledge:

- Basic colorimetry: color-matching functions, standard illuminants.
- Computation of tristimulus values.
- Basics knowledge in physiology of color vision.

Aim and learning outcomes:

To supply an introduction to color difference models and color appearance models and the state of the art in these topics, their historical evolution and present development. Also, basic knowledge on color reproduction methods.

On completion of this course the students will be able to:

- Demonstrate the use of color measurement instruments and the interpretation of color measurement data.
- Demonstrate the computation of color differences using CIELAB-based and advanced color-difference formulas.
- Describe different color difference models.
- Evaluate the agreement between perceived and measured color differences.
- Describe the perceptual attributes of color and the different systems for the representation of color.
- Describe different chromatic adaptation models.
- Describe different color appearance models.
- Demonstrate the computation on different color appearance models.
- Describe the requirements for consistent color reproduction across different media.
- Practical implementation of measurements of the appearance.

Topics to be taught (may be modified):

- Color matching and color threshold experiments. Suprathreshold and large color differences.
- Perceptible and acceptable color differences. Industrial color tolerances.
- Color-difference formulas . The CIE94 and CIEDE2000 color-difference formulas.
- CIECAM02-based color difference models.

- DIN99 and IPT's color-difference approaches.
- Relationships between perceived and measured color differences: PF/3, STRESS.
- Total differences versus color differences.
- Review of Physiology and Psychophysics for vision.
- Color order systems.
- Color appearance phenomena and terminology.
- Definitions and effects of viewing conditions. The appearance attributes of colored materials.
- The structure of light, dark and chromatic adaptations. Corresponding colors. Implementation and testing of different chromatic adaptation transforms (CAT).
- Historical color appearance models (CAM): CIELAB, CIELUV, Nayatani, and Hunt models.
- The structure of CIE color appearance models: CIECAM97's and CIECAM02. CIECAM02 implementation and testing.
- S-CIELAB color-difference formulae. Introduction to an image appearance models: iCAM
- Visual appearance(color + gloss, translucency and texture)
- Visual color matching. Instrumental color matching. Image color matching.
- Management of the transfer of color information between image capture devices and image production devices. Device characterization. Gamut mapping algorithms. Device calibration. Concepts of device dependent and device independent methods of color specification.
- Image quality Measurements. Rendering HDR Images.

Teaching methods: Lectures, laboratory sessions, seminars and homework exercises.

Assistance: Maximum 10% of absence is allow (CIMET rules).

Form(s) of Assessment: Written exam (65%), homework (35%).

External/internal examiner: --

Examination support: None

Literature and study materials: Handouts of the material covered in the lectures will be distributed.

Reference book:

M.D. Fairchild, Color Appearance Models, Second Edition, Wiley-IS&T Series in Imaging Science and Technology, Chichester, UK (2005).

R. S. Berns, Billmeyer and Saltzman, Principles of Color Technology, 3rd ed., John Wiley & Sons, New York, (2000).

K. Witt, "CIE Color Difference Metrics". In "Colorimetry. Understanding the CIE Sytem", Chapter 4. Ed: J. Schanda, Wiley-Interscience 2007.

W.D. Wright, 50 years of the 1931 CIE standard observer for colorimetry, AIC Color 81, Paper A3 (1981).

G. Wyszecki, Current developments in colorimetry, AIC Colour 73, 21-51 (1973).

Additional books:

Digital color management: Encoding Solutions, E. Giogianni & T. Madden, Addison Wesley, (1992).

Colour Engineering, Achieving device independent colour, P. Green & L. MacDonald, John Wiley and Sons Ltd, (2002).

The reproduction of colour, R.W.G. Hunt, Foutain Press, (1995).

Colour physics for industry, R. McDonald, Society of Dyers & Colourists, (1997).

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