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Electronic Imaging

SCIENCE AND TECHNOLOGY

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PROCEEDINGS

Material Appearance 2017

Editors: **Mathieu Hebert**, Université Jean Monnet de Saint Etienne (France)
Francisco H. Imai, Canon U.S.A., Inc. (United States)
Ingeborg Tastl, HP Labs, HP Inc. (United States)

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Society for Imaging Science and Technology
7003 Kilworth Lane • Springfield, VA 22151 USA
703/642-9090; 703/642-9094 fax
info@imaging.org; www.imaging.org

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Material Appearance 2017

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Material Appearance 2017 thanks Conference Sponsor



Introduction

The field of material appearance is in constant evolution and appearance continues to be a crucial issue across a range of industrial domains. It is a signature of quality for manufactured and natural products and a criterion of choice for end-customers. Digital processes tend to replace ancient manual manufacturing, thus providing more repeatable aspects for the produced objects, but depriving the manufacturer of traditional, manual means of appearance improvements. In this evolution, digital imaging takes a central place, from its role in online selling; to medical imaging devices assisting physicians in their medical diagnostics by providing many kinds of images from which visual attributes can objectively be evaluated (in the presence or absence of the patient thanks to the spreading of telemedicine); to production or reproduction of objects by 3D printing (an upcoming, massive manufacturing method), to name only a few examples. Many additional examples can be found in human activity today with comparable technical, economical or societal issues.

Assessing and measuring quality is a big challenge for science, because of the subjective part of appearance perception, and also because of the number of disciplines this subject encompasses: material sciences and chemistry, physics and optics for both modelling and measurement, computer science – for simulation, display, or data analyses, digital imaging, sensorial science, and other disciplines usually discarded from “hard sciences” such as design, psychophysics and psychology, sociology. The Material Appearance conference aims at gathering this broad variety of knowledge, and rendering the current pioneering research in both academic and industrial laboratories for understanding appearance.

Papers have been solicited in the following categories:

Physical and visual material characterization: Scattering and absorption properties, layer thicknesses, optical index, surface topology, color, gloss, texture, translucency, Bidirectional Reflectance Distribution Functions (BRDF), Bidirectional Texture Functions (BTF) and Bidirectional Surface Scattering Reflectance Distribution Function (BSSRDF). . .

Measurement techniques: Spectrophotometry, goniospectrometry, spectral imaging, angular imaging, 3D imaging, OCT, polarized imaging, glossmeters, non-invasive measurements. . .

Modeling: Light scattering, reflection by multilayers, inverse models,

Reproduction: acquisition of object images (spectral, 3D. . .), soft proofing methods for 2.5D and 3D printing, reproduction quality assessment,

Simulation and display: HDR/spectral display for material appearance, virtual proofing for design, physically-realistic image synthesis

Applications: Art, textile, medical, automotive, object design, manufacturing, lighting. . .

The contributions in this 2017 edition of the Material Appearance Conference are fairly well distributed over these different topics.

Material Appearance 2017

Monday January 30, 2017

Surface Measurement and Lighting Systems

Session Chairs: Mathieu Hebert, Université Jean Monnet de Saint Etienne (France), Francisco Imai, Canon U.S.A. Inc. (United States), and Ingeborg Tastl, HP Labs, HP Inc. (United States)

10:50 AM – 12:10 PM

Regency Ballroom C

10:50

Comparison of specular gloss values from a spectrally resolved five-axis goniometer and a reference goniophotometer, *Renée Charrière^{1,2} and Maria Nadal¹ and Clarence Zarobila¹*; ¹National Institute for Standards and Technology (United States) and ²Ecole des Mines de Saint-Etienne (France) [MAAP-273]

6

11:10

A normal vector and BTF profile measurement system using a correlation camera and scanning dome illumination, *Akira Kimachi, Motonori Doi, and Shogo Nishi, Osaka Electro-Communication University (Japan)* [MAAP-274]

13

11:30

Polarimetric multispectral bidirectional reflectance distribution function measurements using a Fourier transform instrument, *Pierre Boher, Thierry Leroux, Ludivine Cave, Thibault Bignon, and Véronique Collomb-Patton, ELDIM (France)* [MAAP-275]

19

11:50

Optimal LED selection for multispectral lighting reproduction, *Chloe LeGendre, Xueming Yu, and Paul Debevec, USC Institute for Creative Technologies (United States)* [MAAP-276]

25

12:10 – 2:00 PM Lunch Break

El 2017 Opening Plenary and Symposium Awards

Session Chairs: Joyce E. Farrell, Stanford University, and Nitiin Sampat, Rochester Institute of Technology (United States)

2:00 – 3:00 PM

Grand Peninsula Ballroom D

Giga-scale 3D computational microscopy, *Laura Waller, University of California, Berkeley (United States)*
 Laura Waller is the Ted Van Duzer Endowed Assistant Professor of Electrical Engineering and Computer Sciences (EECS) at UC Berkeley. She is a Senior Fellow at the Berkeley Institute of Data Science, and received her BS (2004), MEng (2005), and PhD (2010) in EECS from the Massachusetts Institute of Technology (MIT). Waller's talk is on computational imaging methods for fast capture of gigapixel-scale 3D intensity and phase images in a commercial microscope that employs illumination-side and detection-side coding of angle (Fourier) space with simple hardware and fast acquisition. The result is high-resolution reconstructions across a large field-of-view, achieving high space-bandwidth-time product.

3:00 – 3:30 PM Coffee Break

Surface Appearance Modeling and Reproduction Joint Session

Session Chair: Francisco Imai, Canon U.S.A. Inc. (United States)

3:30 – 4:50 PM

Regency Ballroom C

This session is jointly sponsored by: Material Appearance 2017 and Color Imaging XXII: Displaying, Processing, Hardcopy, and Applications.

3:30

Modeling and reproducing effect paints, *Gary Meyer and Avery Musbach, University of Minnesota (United States)* [MAAP-288]

3:50

How to design a recto-verso print displaying different images in various everyday-life lighting conditions, *Nicolas Dalloz¹, Serge Mazauric², Thierry Fournel¹ and Mathieu Hebert¹*; ¹Institut d'Optique Graduate School, and ²University of Lyon, UJM-Saint-Etienne, CNRS, Institut d'Optique Graduate School (France) [MAAP-289]

33

4:10

Appearance decomposition and reconstruction of textured fluorescent objects, *Shoji Tominaga, Keiji Kato, Keita Hirai, and Takahiko Horiuchi, Chiba University (Japan)* [MAAP-290]

42

4:30

Assessing the proper color of translucent materials by an extended two-flux model from measurements based on an integrating sphere, *Lionel Simonot¹, Mathieu Hebert², Serge Mazauric^{2,3}, and Roger Hersch⁴*; ¹Université de Poitiers (France), ²Université Jean Monnet de Saint Etienne (France), ³CPE Lyon, Domaine Scientifique de la Doua (France), and ⁴École Polytechnique Fédérale de Lausanne (Switzerland) [MAAP-291]

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5:00 – 6:00 PM All-Conference Welcome Reception, Atrium

Tuesday January 31, 2017

Surface Appearance Assessment and Digital Methods I Joint Session

Session Chair: Greg Ward, Dolby Laboratories (United States)

9:10 – 10:10 AM

Grand Peninsula Ballroom C

This session is jointly sponsored by: Material Appearance 2017 and 3D Image Processing, Measurement (3DIPM), and Applications 2017.

9:10

Graininess appearance of goniochromatic samples in lighting cabinets, *Paola Iacomussi, Michela Radis, and Giuseppe Rossi, INRIM (Italy)* [MAAP-282]

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9:30

Measurement and evaluation method of orange peel, *Takuroh Sone and Shuhei Watanabe, Ricoh Company, Ltd. (Japan)* [MAAP-283]

62

9:50

Enhanced RTI for gloss reproduction, *Peter Fornaro, Andrea Bianco, Aeneas Kaiser, and Lukas Rosenthaler, University of Basel (Switzerland)* [MAAP-284]

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10:00 AM – 7:30 PM Industry Exhibition

10:10 – 10:50 AM Coffee Break

Surface Appearance Assessment and Digital Methods II Joint Session

Session Chair: Mathieu Hebert, Université Jean Monnet de Saint Etienne (France)

10:50 – 11:30 AM
Grand Peninsula Ballroom C

This session is jointly sponsored by: Material Appearance 2017 and 3D Image Processing, Measurement (3DIPM), and Applications 2017.

10:50 73

Towards a consistent tool-independent virtual material appearance, *Darja Guarnera¹, Giuseppe Claudio Guarnera^{1,2}, Cornelia Denk³, and Mashhuda Glencross⁴; ¹Loughborough University (United Kingdom), ²NTNU - Norwegian University of Science and Technology (Norway), ³BMW Research (Germany), and ⁴Pismo Software (United Kingdom) [MAAP-285]*

11:10 80

Interactive object surface retexturing using perceptual quality indexes, *Keita Hirai, Wataru Suzuki, Yoshimitsu Yamada, and Takahiko Horiuchi, Chiba University (Japan) [MAAP-286]*

11:30 AM – 2:00 PM Lunch Break

El 2017 Tuesday Plenary and Symposium Awards

Session Chairs: Joyce E. Farrell, Stanford University, and Nitin Sampat, Rochester Institute of Technology (United States)

2:00 – 3:00 PM
Grand Peninsula Ballroom D

VR 2.0: Making virtual reality better than reality, *Gordon Wetzstein, Stanford University (United States)*
 Gordon Wetzstein is an Assistant Professor of Electrical Engineering and, by courtesy, of Computer Science, at Stanford University, and leads the Stanford Computational Imaging Group. He received a PhD in computer science from the University of British Columbia (2011) where his doctoral dissertation focused on computational light modulation for image acquisition and display. In his talk, Wetzstein explores the frontiers of VR systems engineering. Eventually, VR/AR systems will redefine communication, entertainment, education, collaborative work, simulation, training, telesurgery, and basic vision research, as next-generation computational near-eye displays evolve to deliver visual experiences that are better than the real world.

3:00 – 3:30 PM Coffee Break

KEYNOTE: Communicating Material Appearance

Session Chair: Ingeborg Tastl, HP Labs, HP Inc. (United States)

3:30 – 4:10 PM
Grand Peninsula Ballroom C

The future of material communication via the Appearance Exchange Format (AxF), *Marc Ellens, Gero Mueller, and Francis Lamy, X-Rite, Inc. (United States) [MAAP-277]*
 Marc S. Ellens is a Senior Research Scientist with X-Rite-Pantone in Grand Rapids, MI. He received his BS in mathematics and computer science from Calvin College, and his PhD in computer aided geometric design from the University of Utah. In the past, Ellens has worked on CNC programming and at Lectra Systemes developing design applications for the textile industry. Now at X-Rite for more than 10 years, he has been involved in research and development efforts beyond color toward the capture and reproduction of appearance. Ellens has presented at the NVIDIA GPU Technology conference, Autodesk's Automotive Innovation Forums, and the IS&T Electronic Imaging Conference. He is named in three patents related to material visualization and reproduction.

Material Characterization

Session Chair: Ingeborg Tastl, HP Labs, HP Inc. (United States)

4:10 – 5:30 PM
Grand Peninsula Ballroom C

4:10 86
Study of the influence of roughness on the gonioapparency of anodized titanium, *Quentin Cridling^{1,2}, Renee Charriere^{1,3}, Damien Jamon⁴, Maria Vittoria Diamanti², Maria Pia Pedeferra², David Delafosse^{1,2}; ¹Ecole Nationale Supérieure des Mines de Saint-Etienne, (France), ²Politecnico di Milano (Italy), ³National Institute of Standard (United States), and ⁴Université de Lyon, Université de Saint-Etienne, Jean Monnet (France) [MAAP-278]*

4:30 92
Adapted modulation transfer function method for characterization and improvement of 3D printing, *Marine Page^{1,2,3}, Gaël Obein², Maria Valezzka Ortiz Segovia¹, Clotilde Boust³, and Annick Razez²; ¹Océ - Canon Group, ²Conservatoire National des Arts et Métiers, ³Centre de Recherche et de Restauration des Musées de France (France) [MAAP-279]*

4:50 101
Evaluating an image based multi-angle measurement setup using different reflection models, *Aditya Sole, Ivar Farup, and Peter Nussbaum, Norwegian University of Science and Technology (Norway) [MAAP-280]*

5:10 108
Model-based skin pigment cartography by high-resolution hyperspectral imaging (JIST-first), *Pierre Seroul¹, Mathieu Hebert², Marie Chereil¹, Romain Vernet¹, Raphael Clerc² and Matthieu Jomier¹; ¹Newton Technologies and ²Université Jean Monnet de Saint Etienne (France) [MAAP-281]*

5:30 – 7:30 PM Symposium Demonstration Session, Grand Peninsula Ballroom E

Thursday February 2, 2017

Interactive Workshop: How can COLOR imaging provide US with powerful INSIGHTS? Joint Session

Moderator: Fritz Lebowsky, STMicroelectronics (France)

2:00 – 3:30 PM

Regency Ballroom C

This session is jointly sponsored by: Color Imaging XXII: Displaying, Processing, Hardcopy, and Applications and Material Appearance 2017.

We would very much like to have you participate in a special session in which we encourage asking questions and exchange ideas that frequently trouble us during research and development projects. The presence of experts in COLOR imaging and perhaps Electronic Imaging at large will provide a unique opportunity of efficiently and lively sharing simple/stupefying ideas enabling fascinating engineering concepts which may also stimulate your own future research and development projects!

Interactive Workshop: How can color imaging provide us with powerful insights?, Fritz Lebowsky, STMicroelectronics (France) [COLOR:062]

3:00 – 5:00 PM Meet the Future: A Showcase of Student and Young Professionals Research, Grand Peninsula Ballroom E

3:20 – 4:00 PM Coffee Break

Interactive Workshop: How can COLOR imaging provide US with powerful INSIGHTS? (cont.) Joint Session

Moderator: Fritz Lebowsky, STMicroelectronics (France)

4:00 – 5:00 PM

Regency Ballroom C

This continuation of the workshop session is jointly sponsored by: Color Imaging XXII: Displaying, Processing, Hardcopy, and Applications, and Material Appearance 2017.