TOPICALITIES

Edited by Markéta Držková

CONTENTS

News & more

New Technical Committees and recent publications of CIE

In 2021, three new Technical Committees (TCs) of the International Commission on Illumination (CIE) were established. The first one, CIE TC 2-95 Measurement of Obtrusive Light and Sky Glow, is a part of Division 2, Physical Measurement of Light and Radiation. It aims to propose appropriate guidelines and provide examples for metrics, measurement methods and corresponding instrument specifications, applicable, e.g., to light pollution assessment and research. The other two TCs work under Division 3, Interior Environment and Lighting Design. While CIE TC 3-59 The Integration of Daylight and Electric Lighting – Photometric, Colorimetric and Radiometric Requirements for the Spectral Design of Indoor Lighting deals with a lighting design approach that considers human comfort and wellbeing together with energy efficiency, the purpose of CIE TC 3-60 Spectral Daylight Characteristics is to review geographical, seasonal and time-of-day variations in the spectral power distribution of daylight for 380–780 nm, propose an updated approach for the calculation of D illuminants at a nominal correlated colour temperature (now defined in CIE 15:2018 Colorimetry, 4th edition), and provide spectral information for CIE standard general sky types.

The publications issued during the past 12 months include CIE x048:2021, Proceedings of the Conference CIE 2021 held last October as a 3-day online event. The proceedings include 107 papers of invited, oral, poster and workshop presentations, which are also available individually in the CIE Webshop. About a third of them are the open-access ones, including those dealing with new approaches to spectral measurement and classification utilising modern machine learning methods, the development of a new goniospectrophotometer for measurement of the bidirectional reflectance distribution function on submillimetre surfaces, chromatic discrimination thresholds in the CAM02-UCS and CAM16-UCS colour spaces, determining the reference white in a complex virtual reality environment, optimising camera placement for a luminance-based shading control system in a real office environment, testing sensitivity to differences in colour fidelity and changes in illuminance for better lighting optimisation, changes in perceived chroma and hue angle at high illuminance levels due to the Hunt effect, and the role of daylight in seat preferences of library users, among others, and the invited paper presenting progress in the inter-disciplinary development of measures for reducing the adverse effects of artificial light at night. In addition, the Abstract Booklet of the Conference CIE 2021 is freely available on the CIE website.

Another document offered for free is the Technical Note CIE TN 012:2021 Guidance on the measurement of temporal light modulation of light sources and lighting systems, prepared by the corresponding committee of Division 2. It provides recommendations on measurement protocols to measure periodic waveforms and light modulations and, to some extent, also non-periodic signals, considering the differences between field and laboratory measurements, measurement equipment and evaluation, as well as reporting of results and measurement uncertainty. It is intended as a guide for the correct measurement of new metrics, like the stroboscopic visibility

Fogra research projects and other news in 2021

Among the projects ending in 2021, four dealt with colour. The outputs of the one focused on the characterisation of colour gamut and standardised colour communication in multi-primary printing include the Fogra ECG-7C test form with the evaluation table for media wedge developed for seven-colour printing, together with the characterisation dataset and ICC-profile of FOGRA55, the exchange colour space based on CMYKOGV. The project that concerned with the colour appearance in full-colour 3D printing explored e.g. deep learning models for optical characterisation of multi-material 3D printers and compared simulated and measured remission spectra. Another project aimed to establish suitable characteristic values for paper in order to reduce the presetting time in high-speed inkjet printing while ensuring reliable colour print production; it involved extensive laboratory testing and printing a variety of paper with different machines. The fourth of these projects employed modelling of changes in colour appearance due to transparent top layer, which considered its thickness, refractive index, the spectral characteristics of the involved surfaces and the lateral spread of the light, to allow reliable colour profiling for coated or laminated products. The fifth project ending in 2021 aimed to further improve a cyclical fatigue analysis of smart cards and thus the predictability of their service life using a standardised method, which can also contribute to their optimised design and manufacturing.

The topics of the ongoing projects include the development of a machine learning framework for dynamic image style evaluation and the improvement of textile colour communication (see also

JPMTR Vol. 9, No. 4). The third one deals with a further reduction of waste and thus also the related CO_2 emissions through paper-dependent pre-adjustment of sheet-fed offset presses based on a new paper characteristic value enabling predictions of solid tone densities and tone value increases, which is to be established from laboratory prints and print tests on a production press.

Three of the new projects started in 2021 are also concerned with offset printing, materials and the environment. One deals with the use of 3D-printed, biodegradable hydrogels for on-demand inactivation of microbial contamination in the dampening solution circuit of presses, another one investigates material compatibility and deinking of mineral oil-free newspaper inks, and the last one aims to develop a standard for seven-colour offset packaging printing. Further, two new projects focus on the uncoated printing papers for high-speed inkjet applications, namely on their properties important for print finishing. While one aims to develop the evaluation method for the perfect binding capability, the other investigates the material and process parameters of foil laminations for the prediction of thermal and mechanical resistance. Finally, the new project in security applications develops standardised performance tests to optimise performance and interoperability in near-field communication technology.

The outcomes of Fogra research are reflected also in its knowledge exchange and sharing activities, such as in the Fogra PSD 2022 handbook with the guidelines for the entire digital printing workflow. The main changes in this new edition, which should be available soon, include coverage of the multicolour printing with the expanded colour gamut (ECG), the introduction of media wedges for RGB and ECG, addition of recent Fogra standards (FOGRA55 to FOGRA60), an overview of the updated tolerances together with the previous tolerance schemas, presentation of the certifications related to ProcessStandard Digital, and the barcode evaluation guidelines.

measure, used in regulations that are coming into force in several regions. New technical reports include CIE 243:2021 Discomfort glare in road lighting and vehicle lighting, CIE 245:2021 Optical safety of infrared eye trackers applied for extended durations, CIE 247:2021 Guide for the gonioradiometric measurement of upper air ultraviolet germicidal irradiation luminaires, and the two presented in more detail below.

CIE 244:2021 – Characterization of imaging luminance measurement devices (ILMDs)

This document prepared under Division 2 deals with imaging luminance measuring devices, also referred to as video photometers, imaging photometers or luminance (measuring) cameras, which are used to record images of luminous and illuminated scenes enabling their complex, spatially resolved analysis. These devices find application in many areas, for example, in the characterisation of light sources and displays, analysis of outdoor and indoor lighting, night vision design, etc. On almost 60 pages, the technical report describes the elements, function, characterisation and calibration of imaging luminance measuring devices, providing guidelines for their use and defining the appropriate quality parameters, such as responsivity uniformity, edge function and shutter and aperture repeatability.

CIE 246:2021 – Colour gamuts for output media

This technical report providing methods for computing and communicating colour gamuts for output devices such as printers and displays was prepared under Division 8, Image Technology. It includes a step-by-step procedure for calculating the volume of colour gamut together with the metrics for comparing two colour gamuts, describes methods for visualisation of a 3D colour gamut surface and presents different methods for defining a colour gamut boundary and encoding its description, including the examples for the CxF-based encoding.

Activities towards higher adoption of 3D printing in Sweden

Based on the results of a feasibility study analysing the industrial needs for an open test and demonstration environment for additive manufacturing, which was finished in 2021, RISE (Research Institutes of Sweden) together with 15 industrial and academic partners, including Ericsson, Nikon Metrology Europe, Siemens Energy, Volvo Group, and the Chalmers University of Technology, among others, have recently established the Application Center for Additive Manufacturing as a collaboration platform supporting the development and adoption of additive manufacturing that is seen as a technology important for the transition to a sustainable industry.

In addition, the two-year 3D-Action project, also launched in 2021 and connected with the Application Center for Additive Manufacturing through the shared infrastructure and personnel, should help increase awareness and knowledge about additive manufacturing and its benefits for small and medium-sized companies in the Västra Götaland region. The approach employs the dedicated seminars providing an insight into the 3D printing technology and its opportunities based on the experiences of companies that already have used the technology for some time, the feasibility studies conducted in the interested companies, and, for the companies with an identified potential in adopting the additive manufacturing technology, the in-depth and hands-on training and education.

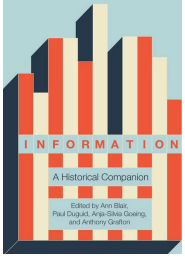
Bookshelf

Information
A Historical Companion

This comprehensive volume explores the approaches to documenting facts and knowledge and sharing information, as well as the related concepts, practices and technologies. Contributed by an international team of more than a hundred experts, the book covers the development from ancient times to the present information age.

A third of the book presents a collection of 13 chapters that provide an insight into the evolution of acquiring, processing, storing and distributing information in premodern regimes, the medieval Islamic world, early modern East Asia and Europe, the interconnecting world in the 16th century, the role of writing offices, periodicals, the commercialisation of information, capitalism, 19th-century media technologies, and networking in the modern world. This part also discusses publicity, propaganda, public opinion, communication, computation, and search. The second part offers over 100 alphabetical entries on selected topics from accounting to xylography. These deal, among others, with algorithms, censorship, computers, data, digitisation, encrypting/decrypting, error, files, forgery, indexing, journals, notebooks, printed visuals, proofreaders, readers, recording, reference books, scrolls, teaching, telecommunications, and travel. In addition, the volume includes a glossary and index, as well as recommendations for further reading.

The book covers all kinds of communication media, including social media – not only the currently dominating ones, such as Facebook, Instagram and Twitter, but also the past or more focused ones, namely Friendster, Grindr, Match, MySpace and Tinder. Naturally, printing is mentioned many times throughout the whole text. Besides its use for advertising and production of books, diagrams, images, manuals, maps, newsletters, newspapers, periodicals, sales catalogues, etc., or connection with technology, such as cameras, colour reproduction, hot metal, letterpress, movable type and linotype, lithography, photocopiers, portable presses, printing on rolls, steam, stereotype, and woodblock printing, the book explores its relationship with the art of memory, bibliography, capitalism, Catholics, commodification, communication, ethnography, excerpting, Google Print, information policy, intellectual property, journalism, letters, libraries, literacy, merchants, money, networks, office practices, plagiarising, political reporting, privacy, publication, regulation, scribes, search, surveilling, translating, typography, and other. The book also describes its development and impacts in different parts of the world. Other topics treated in detail are materials, especially papyrus, parchment, silk and paper, devices used for communication, various aspects and applications of digital technologies, Silicon Valley, the projects of Google, important persons, such as Gutenberg and Claude Shannon, professions, e.g. scribes and secretaries, the mutual relationship between information and science, the role of organisations such as the National Science Foundation and the Royal Society, quantification and statistics, and much more.



Editors: Ann Blair, Paul Duguid, Anja-Silvia Goeing, Anthony Grafton

Publisher: Princeton University Press
1st ed., January 2021
ISBN: 978-0-691-17954-4
924 pages, 43 images
Hardcover
Available also as an eBook

Environmental and Financial Performance Evaluation in 3D Printing Using MFCA and LCA

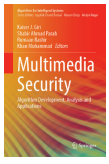
Authors: Tiago Y. Kamiya, Marcell M. Corrêa Maceno, Mariana Kleina

Publisher: Springer
1st ed., March 2021
ISBN: 978-3030696948
77 pages, 45 images
Softcover
Also as an eBook

Part of the SpringerBriefs in Applied Sciences and Technology series, this book deals with the methodology for 3D printing performance evaluation. It defines seven main steps comprising the identification of the problem and definition of printing parameters, definition of a product to be printed, preparation of printing process flow diagram, definition of the printed product life span, definition and collection of data for printed product life-cycle assessment (LCA) and material flow cost accounting (MFCA), and finally the comparative assessment of 3D printing financial and environmental performance. The application of the proposed approach is presented for a real case of a 3D-printed clearance gauge with the comparison of polylactic acid and polyethylene polyterephthalate glycol.

Multimedia Security
Algorithm Development, Analysis and Applications

Editors: Kaiser J. Giri, Shabir A. Parah, Rumaan Bashir, Khan Muhammad

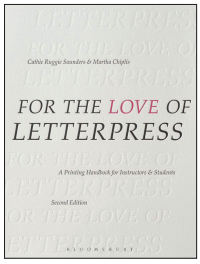


Publisher: Springer
1st ed., January 2021
ISBN: 978-9811587108
314 pages, 134 images
Hardcover
Also as an eBook

Three parts of this new reference present the methods reducing threats due to insecure multimedia communication – security using cryptography and chaotic theory, information embedding for secure data communication and authentication, and security in the Internet of Things and enterprise driven by Big Data.

For the Love of Letterpress
A Printing Handbook for Instructors and Students

This handbook makes clear why letterpress still attracts students and how it helps to master typography. The authors share their skills and experience, covering all steps in the production of letterpress prints and different aspects to consider. The well-illustrated text clearly explains all terms and guides through the whole process while providing an insight into reasons for dos and don'ts. After elucidating the fascination of letterpress and the value of its historical legacy, the authors introduce the basics in terms of measurement units, the lay of the case, spacing and leading, the procedure from type setting and alignment to tying up the form, proofing and press operation, up to cleaning the press after printing. They also describe presses and discuss the choice of ink and paper for proofing and printing, lockup, checking the impression, make-ready, registering multiple colours and editioning. One chapter presents various relief matrices. Building upon these fundamentals, the following chapter provides examples of contemporary processes and experimental techniques, e.g. split fountain printing, debossing and intentional ghosting. In three chapters, the authors advise how to create a concept, envision the object considering, among others, the relationship of content and structure, as well as appropriate typefaces, paper and colours, and assess the resulting work. The last chapter before the closing part is new and presents a collection of letterpress assignments to try. Same as the first edition published in 2013, also this new one received an American Graphic Design Award from Graphic Design USA.



Authors: Cathie Ruggie Saunders, Martha Chiplis

Publisher: Bloomsbury Visual Arts
2nd ed., August 2019
ISBN: 978-1-350-05128-7
208 pages, 242 images
Softcover
Available also as an eBook

Screenprinting on Textiles
The Complete Guide

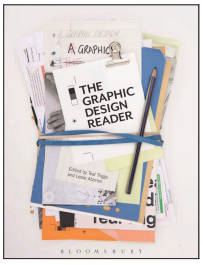
This new book is also written by an expert with long and rich experience, embracing both traditional and contemporary techniques and approaches. It introduces the fundamentals of printing on textiles, designing for print, making stencils, carrying out make-ready, and printing. In the next chapters, it shows how to work with dye pastes and colourants, achieve the required texture, shape, shine, embellish and finish, utilise scale and repeat, and shares other practical tips and recommendations.

Author: Sue Westergaard

Publisher: The Crowood Press
1st ed., November 2020
ISBN: 978-1-78500-753-8
224 pages
Hardcover
Available also as an eBook

The Graphic Design Reader

This anthology, "dedicated to graphic design students everywhere", brings 90 articles that are well organised into seven thematic parts, each of which is framed by the introduction and recommendations for further reading. Written content is complemented by 160 figures. The first part, 'History of graphic design and graphic design history', is the most extensive one, beginning with essays by W. A. Dwiggins and William Morris and ending with the article by Chuck Byrne and Martha Witte exploring the concept of deconstruction. Two sections deal with graphic design from the 19th century to 1980 and from the 1980s to the present, while the third one explores the evolution of graphic design isms. The following six parts focus on 'Education and the profession', 'Type and typography', 'Graphic design, critical writing and practice', 'Political and social change', 'Changing visual landscapes' and 'Graphic design futures'. Each of them collects about a dozen of articles split into two sections. Some of them are visual essays: the one presenting a subjective family tree of (mostly) American graphic designers (1960–2011) in Part 2, 'This year there is no manifesto', 'Design and reflexivity' and the one showcasing the development of hip-hop typographic ornaments in Part 5, and 'RCA graphic design: 1960s–2010s' in Part 7. The volume concludes with an epilogue by the editors, followed by a rich bibliography and index.



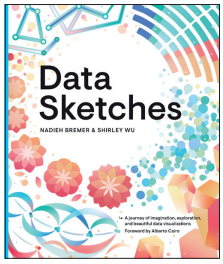
Editors: Teal Triggs, Leslie Atzmon

Publisher: Bloomsbury Visual Arts
1st ed., February 2019
ISBN: 978-1-4725-3620-4
997 pages
Hardcover

Data Sketches
A journey of imagination, exploration, and beautiful data visualizations

This book is a part of AK Peters Visualization Series, which now includes seven books (also Visualizing with Text presented in JPMTR Vol. 10, No. 2). In this new one, the authors present their approaches to creative coding in 24 data visualisation projects on 12 different, more or less abstract themes: movies, Olympics, travel, presidents and royals, books, music, nostalgia, nature, culture, community, myths and legends, and fearless. After the opening part explaining the concept and introducing technologies and tools, almost 400 pages of the main part track for each project the whole process – from data gathering and sketching to coding and resulting data visualisation graphics. For better insight, the illustrations include drafts and notes.

Authors: Nadieh Bremer, Shirley Wu



Publisher: CRC Press
1st ed., February 2021
ISBN: 978-0-367-00012-7
428 pages, 132 images
Hardcover
Available also as an eBook

Perspectives on Design and Digital Communication II
Research, Innovations and Best Practices

Editors: Nuno Martins, Daniel Brandão, Fernando Moreira da Silva

Publisher: Springer
1st ed., May 2021
ISBN: 978-3030758660
461 pages, 131 images
Hardcover
Also as an eBook

This volume brings 28 chapters with invited papers and contributions based on the best papers presented at Digicom 2020 (for the conference proceedings, see JPMTR Vol. 9, No. 4). It includes two review articles dealing with the design of visual interfaces for seniors, papers discussing the role of observation and intuition in design practice and research, the future of design doctoral studies in the context of the 4th industrial revolution, the process of modelling a digital font to a 3D-printed letterpress type, design-led branding, functional graphic design for musical writing, a concept of data artification, and more.

Understanding – Combining Typefaces
Typeface combination as a stimulus in typography

Author: Philipp Stamm

Publisher: Birkhäuser
1st ed., June 2021
ISBN: 978-3035611144
360 pages, 275 images
Hardcover

This new book helps to understand the typeface features most important for creating a functional and aesthetic design. Besides explaining the basics, it provides historical insight and revised classification of fonts. The relevant characteristics and factors to consider when combining typefaces, benefiting from a systematic analysis of analogy and contrast, are clearly illustrated in numerous examples. The German edition was published at the end of 2020.

Organic Semiconductors for Optoelectronics

Editor: Hiroyoshi Naito

Publisher: Wiley
1st ed., August 2021
ISBN: 978-1119146100
384 pages
Hardcover
Also as an eBook

In this new book on organic semiconductors, the first nine chapters review the current knowledge of their electronic structures, mechanisms of electronic transport, theoretical treatment of optical properties, light absorption and emission properties, and characterisation of their properties using impedance spectroscopy, time-of-flight measurement, microwave and terahertz spectroscopy, electron spin resonance spectroscopy, and second harmonic generation spectroscopy. The remaining six chapters present the advances and future trends in organic field-effect transistors, organic light-emitting diodes and organic photovoltaics.

Sustainability in the Textile and Apparel Industries
Production Process Sustainability

Editors: Subramanian S. Muthu, Miguel A. Gardetti

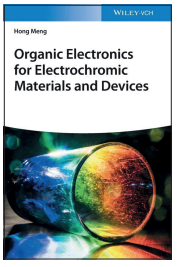
Publisher: Springer
1st ed., April 2020
ISBN: 978-3030385446
222 pages, 157 images
Hardcover
Also as an eBook

The first chapter of this new book deals with printing on textiles using sustainable natural dyes and pigments. The following chapters cover innovative technologies for sustainable textile colouration, patterning and surface effects, cellulose textile colouring with clay particles, ozone as an alternative oxidant, sustainable textile processing with zero water utilization, and other recent developments in sustainable approaches applicable in textile dyeing, finishing and spinning.

Organic Electronics for Electrochromic Materials and Devices

The author of this new volume brings a comprehensive account of organic electrochromic materials and their applications. The first chapter provides a brief overview of six generations of electrochromic materials and introduces their key parameters – electrochromic contrast, switching time, colouration efficiency, optical memory, and stability. Ten chapters then discuss in detail advances in polymer electrolytes for electrochromic applications, electrochromic small-molecule materials, conjugated polymers, triarylamine-based polyimides and polyamides, and metallo-supramolecular polymers, electrochromism of viologens and metallohexacyanates, electrochromism based on metal–organic frameworks, covalent organic frameworks and porous structures, especially nanostructures, and organic electroluminochromic materials. The following two chapters are dedicated to organic photoelectrochromic devices and the utilisation of organic electrochromic devices in smart windows, dimmable rearview mirrors, sensors, displays and other applications. The next one reviews commercial organic electrochromic materials and the related patents. The last chapter discusses the main challenges for the commercialisation of organic electrochromic materials, in particular in terms of their long-term stability, the mechanical stability of flexible devices and their encapsulation, and large-area process technologies, including inkjet printing, spray coating and screen printing.

Author: Hong Meng

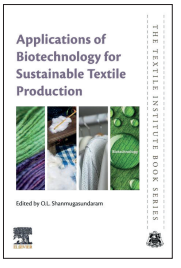


Publisher: Wiley-VCH
1st ed., July 2021
ISBN: 978-3-527-34871-8
528 pages
Hardcover
Available also as an eBook

Applications of Biotechnology for Sustainable Textile Production

This new book begins with an overview of textile fibres and forms. The second chapter provides the techno-economic analysis of current processes in the textile industry considering price components, plant capacity, costs, hazards, wages, gender equality, law requirements and many other factors. In seven chapters, it reviews biotechnological approaches in desizing, scouring, sustainable pre-treatment, dyeing, printing and finishing of textile materials, including the advanced flame-retardant, antimicrobial, crease-resistant and UV-resistant finishes utilising biochemicals. The next chapter presents biotechnological and nano-biotechnological approaches in the treatment of textile effluents, followed by a conclusion and future scope.

Editor: O. L. Shanmugasundaram



Publisher: Woodhead Publishing
1st ed., September 2021
ISBN: 978-0-323-85651-5
276 pages
Softcover
Available also as an eBook

Bookshelf

Academic dissertations

In Situ Investigation of the Highly Dynamic Interfacial Instability in the Cylinder Gap

The study of the phenomena occurring in the gap between the substrate and the printing forme of a gravure printing machine carried out in this thesis contributes to the research of transport and wetting processes for the production of thin, homogeneous and closed layers, which is important for functional printing. In particular, the aim was to provide an in situ insight into the printing nip to increase understanding of fluid splitting and the formation of finger-shaped structures. The work employed a high-speed camera capturing the images of the printing forme surface and the ink layer formed during the operation of an upscaling laboratory printing system. The acquired image sets were processed to automatically identify the finger-shaped structures and determine the mean finger frequency as a characteristic quantity of the highly dynamic interfacial instability to investigate the influence of the printing speed and the geometric properties of the printing forme. The dissertation brings a comprehensive and well-illustrated account of the study. It provides the background on the gravure printing process and printing forme, rheology of fluids, fluid splitting and viscous finger formation, camera measurement technology, and image data processing. Next, it details the experimental setup and characteristics of its components – the printing system, printing forme, glass substrate, optical substrate carrier, high-speed camera, light source and diffuser, along with important considerations regarding the exact setting of the substrate guide height, the depth of field of the optical detection system and the maximum printing speed. The following chapters describe the experimental design and evaluation method, present the obtained results and discuss the fluid-splitting regime, scaling law for the mean finger frequency and limitations of the study. While the dependence of the mean finger frequency on the printing speed was not observed, nor its dependence on the cell volume, the results showed a significant influence of the screen frequency. The revealed lock-in phenomenon is explained by the contact between the substrate and the printing forme, which is not assumed in the existing models describing flow profiles in the cylinder gap.

Doctoral thesis – Summary

Author:
Julian Konrad Schäfer

Speciality field:
Mechanical Engineering

Supervisors:
Edgar Dörsam
Ilia Roisman
Hans-Jürgen Butt

Defended:
14 October 2020, Technical University of Darmstadt, Department of Mechanical Engineering, Institute of Printing Science and Technology Darmstadt, Germany

Language:
German

Original title:
In situ Untersuchung der hochdynamischen Grenzflächeninstabilität im Zylinderspalt

Contact:
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Further reading:
DOI: 10.25534/tuprints-00014204

Formulation of 3D Printable Edible Materials for Innovative Recipes

Food 3D printing is a technology with great development potential in the context of a growing trend of personalised food. This thesis focused on the formulation and production of food materials with the aim to gain an understanding of the mechanisms of their transformation during mechanical and heat treatment to be able to propose a specification of ingredients, printability indicators and processing routes for the production of printed foods of varying texture and composition. The approach employs the use of wheat flour as a starting raw material and its combination with sucrose, sunflower oil, milk, stirred yoghurts, and fruit and vegetable purees as the complementary ingredients fulfilling the requirement on the lowest level of processing. The research investigated the structuring mechanisms of wheat flour dough in dependence on the water content in a higher concentration range than that usually studied and the number and sequence of mechanical and heat treatment operations, the options to modify material rheology to

Doctoral thesis – Summary

Author:
Laurena Masbernat

Speciality field:
Food Engineering

Supervisors:
Camille Michon
Giana Almeida
Sophie Berland

Defended:
4 February 2021, Université Paris-Saclay, INRAE, AgroParisTech, UMR SayFood Massy, France

Language:
French

Original title:
Mise au point de matériaux alimentaires imprimables en 3D permettant la création de recettes innovantes

Contact:
laurenamasbernat@orange.fr

Further reading:
https://tel.archives-ouvertes.fr/tel-03190867

ensure good printability, the influence of various complementary ingredients on the structuring of the cereal material and its printability, the levers for ensuring good print quality, and the possibility to use drying as a post-printing step for modification of the mechanical properties of the printed food. The first step in the research design comprised the study of the dough structure, followed by characterisation of its rheology and determination of its printability.

The first part of the extensive dissertation reviews the state of the art in the field considering 3D printing, cereal material formulation and behaviour of dispersions. The second part defines the objectives and strategy and the third one provides experimental details. The fourth part presents the results of the experiments comprising the structuring of wheat flour doughs highly hydrated by mechanical or thermomechanical treatment, diversification of the cereal material composition by incorporation of ingredients of both plant and animal origin, and optimisation of 3D printing and drying methods. The fifth part reviews the identified technological routes and discusses the role of water and solid ingredients along with considerations for extrusion-based 3D printing of dense particulate systems.

Doctoral thesis – Summary

Author:
Devin John Roach

Speciality field:
Mechanical Engineering

Supervisor:
H. Jerry Qi

Defended:
28 April 2021, Georgia Institute of Technology, Woodruff School of Mechanical Engineering Atlanta, Georgia, USA

Contact:
djroach@sandia.gov

Further reading:
http://hdl.handle.net/1853/64721

Developing Intelligent Structures and Functional Devices Using Novel Smart Materials and Multi-Material Multi-Method (m^4) 3D Printing

Despite its extensive development, 3D printing still has great potential for further growth. The research in this thesis explores novel manufacturing methods, smart materials and structural design combining multiple materials to print a variety of multi-functional components and devices. After a concise overview of relevant advances in the field, the dissertation presents four research projects. The first one comprised building a multi-material multi-method (m4) 3D printer that integrates four deposition technologies, namely inkjet printing, fused filament fabrication, direct ink writing, and aerosol jetting, in combination with robotic pick-and-place arms and modules for photonic and UV curing. The work describes the hardware, its control, required coordinate transformations and software development. It demonstrates the functionality of the multi-material printer on a 3D-printed wheel, three different interface shapes and soft pneumatic actuators. Also, it presents m4 3D printing with implemented machine vision. The next step comprised the use of the m4 3D printer for electronics manufacturing. The presented examples include a stretchable light ribbon, multi-layer circuit board with vertical interconnect access through conductive lines, digital LED light with the chip assembled into the 3D-printed structure using pick-and-place, thermocouple, triboelectric nanogenerator and fuse. In addition, the chapter discusses surface modifications of parts made by fused filament fabrication and shows an approach based entirely on utilisation of the m4 3D printer where the surface of 3D-printed polyetherimide substrates was modified by inkjet printing poly(ethylene glycol) diacrylate and polyimide. Further, the work presents the m4 3D printer applicability to smart materials development, in particular, the design and fabrication of long fibres of liquid crystal elastomers, further enhanced by the addition of magnetic particles, as well as their use to produce three types of actuators. Finally, the above-described methods and materials were employed in the fabrication of different smart textiles, twined fibres mimicking bicep muscle contraction and relaxation, and a number of directly 4D-printed smart structures, including a hinge, sequentially folding box, soft robotic gripper and hand, tunable antenna device, and also reversible actuators with high stiffness, demonstrated on a shape-reconfigurable torque wrench.

Events

EI 2022 – IS&T International Symposium on Electronic Imaging

https://www.imaging.org
17–21 & 24–27 January 2022

The second online edition of this event features 17 technical conferences with 16 keynotes, three plenary sessions and a symposium-wide interactive poster session. The plenary speakers of the first week are Eric R. Fossum, presenting a concept of the Quanta Image Sensor (QIS), its state-of-the-art implementations and future applications, and Larry Matthies, highlighting new technologies used in the Perseverance rover and the Ingenuity helicopter in the current Mars mission. The plenary session in the second week offers the lecture by Joyce Farrell, describing the open-source software for simulations helping to design novel imaging systems and generate data for machine learning applications, and a panel discussion on the benefits and risks of virtual reality.

The short courses start on 11 January, in a week before the main programme. The four-day schedule includes 25 courses, in part presented live and in part covered by the EI 2021 recordings. The former is the case for all courses on image quality and the latter for all courses on artificial intelligence and machine learning; both types of courses can be found in the other tracks covering 3D imaging, cameras, sensors, colour science, and more. The recordings of live sessions will be available until 15 May 2022.

SPIE Events

Photonics West 2022

San Francisco, California, USA
22–27 January 2022

After the 2021 virtual edition, the current one is announced as an in-person event. It features over two thousand presentations, a few tens of which are related to printing technology, such as the one dealing with light control corrections in scattering materials for 3D printing and the papers presenting optical waveguides for complex low-cost optical networks printed using flexography and studies of a printed optical transmission path regarding its data transmission behaviour at fast-ethernet rates. In addition, the event is co-located with SPIE AR | VR | MR taking place on 23–25 January.

Smart Structures / Nondestructive Evaluation 2022

Long Beach, California, USA
6–10 March 2022

Applications of printing are represented also among hundreds of papers included in the programme of this event, e.g., those presenting the all-printed flexible and morphing electronics and inkjet-printed electro-adhesive pads.

Ongoing changes in the calendar of events

Some of the events presented in the previous issue had to be postponed or switched to online due to the emergence of the Omicron variant of COVID-19. Digital Print for Packaging (8–9 December 2021) was held in an online format instead of taking place in Amsterdam, Netherlands. Two shows organised by Tarsus Group were postponed: Labelexpo Asia in Shanghai, China, with the new dates to be announced and Gulf Print & Pack in Dubai, UAE, to 24–26 May 2022. Similarly, the new ESMA conference, Industrial Print Integration (IPI) in Düsseldorf, Germany, was cancelled for 2021 and should take place on 17–18 May 2022. Meanwhile, the "Pre-Flight" webinars with IPI speakers can be joined for free on five days from 1 February to 12 April, when also the results of the Paperonics project will be presented.

Among the in-person events that have been planned for the first quarter of 2022, the Optical Document Security conference was postponed from January to be held jointly as Optical & Digital Document Security on 11–13 April in the same venue (Vienna, Austria). The 9th edition of C!print in Lyon, France, postponed from 2021, was shifted once more to 10–12 May 2022. The Colour Management Symposium organised by Fogra was shifted from March to 6–7 July. The recording of Fogra Colour Management Café 33 'Why is colour' is now available online for free.

Color22

La Jolla, California, USA
22–25 January 2022

This PRINTING United Alliance event dedicated to achieving accurate and consistent colour again offers a workshop, panel discussion, keynotes, and many lectures on the topic.

4D Printing & Meta Materials Conference

https://www.4dpmmconference.com
22 February 2022

The topics announced for this half-day online event organised by Jakajima include 4D printing of hydrogel materials, the temperature-memory effect in 3D-printed auxetic structures, material programming for 4D printing, 3D-printed soft robotic grippers with integrated metamaterials, development of a new flexible wing concept for unmanned aerial vehicles utilising 4D printing, and more. A few weeks later, on 29–30 March 2022, Jakajima holds the 8th edition of the 3D Medical Printing Series, combining four conferences in the field. It is planned as a hybrid event, which can be joined online or attended live in Veldhoven, The Netherlands.

High Security Printing Latin America

Mexico City, Mexico
14–16 March 2022

The 2022 edition is announced as an on-site event. The attendees of the pre-conference seminars on the first day can learn about the ways to reduce environmental impact, benefits and risks of digitised identity, and security printing in the digital age. The programme of the following conference features over 40 speakers.

InPrint Munich

Munich, Germany
15–17 March 2022

In 2022, the Munich edition of the International Exhibition of Print Technology for Industrial Manufacturing is co-located with the 12th International Converting Exhibition and the International Exhibition for the Corrugated and Folding Carton Industry.

VISIGRAPP 2022
17th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications

https://visigrapp.scitevents.org
6–8 February 2022

This established event joining four international conferences covering the theory and applications of computer vision (VISAPP), computer graphics (GRAPP), information visualisation (IVAPP), and human–computer interaction (HUCAPP) is held in a virtual format for the second time, again together with SENSORNETS, the 11th International Conference on Sensor Networks. The technical programme of VISIGRAPP 2022 collects dozens of oral and poster presentations and offers four keynotes: 'Wearable human augmentation' by Roope Raisamo, 'Brain computer interfaces for extended reality' by Fotis Liarokapis, 'The risky business of visualizing known unknowns for decision making with maps' by Sara I. Fabrikant, and 'Neural implicit representations for 3D vision and beyond' by Andreas Geiger.

innoLAE 2022
Innovations in Large-Area Electronics

http://innolae.org
22–24 February 2022

The 8th edition of the annual innoLAE event is also held online for the second time in a row, including the courses on the first day. The conference programme starting on 23 February features four plenary keynote lectures – 'Electronic skins and the next-generation wearables for medical applications' by Takao Someya, 'Soft, skin-interfaced hybrid electronics for clinical-grade wearables' by John Rogers, 'PlasticARM: Challenges of TFT VLSI on a flexible substrate' by John Biggs, and 'Print-in-place and recyclable electronics from nanomaterials' by Aaron Franklin. The schedule includes panel discussions, poster sessions and oral presentations that are split into two tracks, with more than ten invited speakers from academia and leading companies in the field.

LOPEC 2022

Munich, Germany
22–24 March 2022

The 2022 edition of this event dedicated to printed electronics is announced to be held in-person, keeping the proven format with short courses, plenary sessions, conferences covering the business, technical and scientific topics in oral and poster presentations, as well as the trade fair on the last two days with the Start-up Forum, the open OE-A Competition and more. The technical topics include smart and hybrid systems, user interfaces, wearable electronics, biomedical and healthcare applications, upscaling production and manufacturing processes, energy, smart textiles, substrates and encapsulation, circular economy and green electronics, flexible and large-area displays, functional materials, lighting, and 3D structural electronics. The scientific sessions cover advanced materials, strategic devices, innovative processes, smart sensors, and circuit design, simulation and systems.