

TOPICALITIES

Edited by Markéta Držková

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News & more

New and modified ISO standards for graphic technology

The following overview includes new and revised technical specifications and standards, developed under the direct responsibility of the technical committee ISO/TC 130 and published recently; the documents that passed the systematic review and remain current are presented in the side column.

ISO/TS 10128:2023

Graphic technology – Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data

The first version of this standard from 2009 specified three methods for adjusting the digital content data to accomplish consistency in the printed results among different presses, namely using matching tone value curves based on the tone value increase (TVI), near-neutral scales, or CMYK to CMYK multi-dimensional transforms. The original edition is now replaced by this second one, which was published in November 2023 after more than two years of development. The current standard adds the fourth method for press calibration – the colour-optimised correction curve set. It also adds another measure of printed tone as an option for the first method – colour tone value (CTV), describing the apparent halftone area for colour according to ISO 20654, which defines the procedure for the measurement and calculation of spot colour tone value, see JPMTR Vol. 6, No. 3 (2017); however, in the scope of ISO/TS 10128, applicable to printing systems that use CMYK colourants, it can also be applied for process colours.

ISO 12643-1:2023, ISO 12643-2:2023, ISO 12643-3:2023, ISO 12643-4:2023 and ISO 12643-5:2023

Graphic technology – Safety requirements for graphic technology equipment and systems

Part 1: General requirements

Part 2: Prepress and press equipment and systems

Part 3: Binding and finishing equipment and systems

Part 4: Converting equipment and systems

Part 5: Manually-fed stand-alone platen presses

Since November 2023, new versions of all five parts of this standard, which harmonises requirements of the applicable U.S. and European safety standards and is relevant especially to machine manufacturers of all sizes and various health and safety bodies, are available. The first three parts, previously in the second editions from 2009 and 2010, are now in the third edition, while the last two parts, originally published in 2010, are now in the second edition.

The general requirements in the most extensive Part 1 address recognised hazards related to mechanical and electrical performance, slipping, tripping and falling, ergonomics, noise, ultraviolet and laser radiation, fire and explosion, thermal processes, substances and material used for processing, control system failure or malfunction, or emissions such as ozone, ink mist, volatile organic compounds, etc. The current edition includes revised requirements for guards, hold-to-run controls, reel unwinding and rewinding devices and

Recently reviewed and confirmed ISO standards for graphic technology

Among the standards confirmed for the first time, ISO 19593-1:2018 Graphic technology – Use of PDF to associate processing steps and content data – Part 1: Processing steps for packaging and labels, see JPMTR Vol. 7, No. 3 (2018), remains current after the review in 2023; however, the committee draft of the second edition was registered in November 2024 and the new version is now under development.

Other three recently confirmed standards were published later in 2018 and presented in JPMTR Vol. 8, No. 3 (2019); these include ISO 19302 Graphic technology – Colour conformity of printing workflows, ISO 20294 Graphic technology – Quantification and communication for calculating the carbon footprint of e-media, and ISO 21632 Graphic technology – Determination of the energy consumption of digital printing devices including transitional and related modes; the last one with Amendment 1 from 2020.

The remaining ISO documents that were first reviewed and confirmed recently comprise the standard ISO 20677:2019 Image technology colour management – Extensions to architecture, profile format, and data structure, see JPMTR Vol. 8, No. 3 (2019), and three technical specifications. The latter were all published in 2020 and presented in JPMTR Vol. 10, No. 3 (2021). Namely, they include ISO/TS 15311-1 Graphic technology – Requirements for printed matter for commercial and industrial production – Part 1: Measurement methods and reporting schema (Edition 3), ISO/TS 19303-1 Graphic technology – Guidelines for schema writers – Part 1: Packaging printing, which was confirmed in 2023 and since 2024 its revision has started, and ISO/TS 23031

Graphic technology – Assessment and validation of the performance of spectroradiometers and spectrodensitometers.

In the group of repeatedly reviewed and confirmed standards, the oldest one is ISO 11084-1:1993 Graphic technology – Register systems for photographic materials, foils and paper – Part 1: Three-pin systems (for the fifth time). This standard specifies the positions and dimensions for the register holes and pins and is very short. Further, all four parts of ISO 12637 Graphic technology – Vocabulary were reconfirmed in 2024. Part 1: Fundamental terms (2006), Part 2: Prepress terms (2008), and Part 4: Postpress terms (2008) were confirmed for the fourth time, while the newest one, i.e. Part 3: Printing terms from 2009, for the third time.

It is also the longest part, defining almost 150 terms for printing systems and processes. When published, it also incorporated the terms and definitions from ISO 12637-5:2001 Graphic technology – Multilingual terminology of printing arts – Part 5: Screen printing terms, which was at the same time withdrawn.

Finally, the recently reviewed standards include four documents from 2013, all confirmed for the second time. These are ISO 12640-5 Graphic technology – Prepress digital data exchange – Part 5: Scene-referred standard colour image data (RIMM/SCID), two parts of ISO 12647 Graphic technology – Process control for the production of half-tone colour separations, proof and production prints, Part 1: Parameters and measurement methods and Part 3: Coldset offset lithography on newsprint, both in the third edition, and ISO 16759 Graphic technology – Quantification and communication for calculating the carbon footprint of print media products. The last one guides printers, print buyers, consumers, industry and any other interested parties in communicating and verifying carbon footprint information. It considers processes, materials and technologies required to produce print media products and allows for calculations of their whole or part life cycle.

transport systems, pile carrier movements at feeders and deliveries, and adds a new section on doctor blades, while interlocks are covered in other parts. Further, it revises the requirements for UV radiation, explosion and fire protection, and control systems. Also, it clarifies some descriptions and incorporates other changes, e.g. adapted colours, listings of the validation methods for all safeguarding measures and the noise comparison values.

The revisions made to Part 2 of ISO 12643 include definitions and requirements for large-format inkjet printing machines, new requirements for in-running nips on anilox rollers and cylinders or rollers in gravure printing presses, the movement of the inkjet heads when closing a protective device, dust protection, emergency stop devices and stop/safe pushbuttons for web offset printing presses, as well as the changes in the requirements for securing whole body access on deliveries and automatic or semi-automatic printing plate changing. In Part 3, the new requirements are related to feeders and feeding sections at gathering machines, milling head cutters and emergency stop at perfect binders, and retraction of knife and clamp at guillotine cutters. The revised requirements deal with residual pile monitoring on hopper feeders and gathering machine feeders, as well as temperature control and monitoring in the glueing unit of perfect binders and hardcover lines. The current edition of Part 4 includes the changes in the requirements for corrugated board machinery, e.g. the movable splicer module, and new requirements for the delivery of automatic flatbed die-cutting machines. Part 5 revises the requirements related to access from the front side, timer-controlled operation and stopping distance and performance, and defines new requirements for positioning laser scanners, using vision-based protective devices, and the content of the instruction handbook.

ISO 15339-1:2024

Graphic technology – Printing from digital data across multiple technologies – Part 1: Principles

This standard describes the use of colour characterisation data and their adjustment for substrate colour differences. It replaces the publicly available specification ISO/PAS 15339-1:2015, see JPMTR Vol. 4, No. 3 (2015).

ISO/TS 18621-22:2024 and ISO/TS 18621-31:2024

Graphic technology – Image quality evaluation methods for printed matter

Part 22: Evaluation of colour graininess

Part 31: Evaluation of the perceived resolution of printing systems with the Contrast-Resolution chart

The new Part 22 from May 2024 specifies test and measurement conditions and a procedure for computing the colour graininess score, S_{CG} , to quantify microscopic but visible aperiodic fluctuations of colour in the printed image. The second version of Part 31 from January 2024 replaces the 2020 edition, see JPMTR Vol. 12, No. 3 (2021); the work on the third edition is in progress.

ISO 24487:2023

Graphic technology – Processless lithographic plates – Evaluation methods for characteristics and performance

This document from December 2023 replaces ISO 24487-1:2021, see JPMTR Vol. 11, No. 3 (2020). Besides removing the part number, the new version adds definitions of plate tone value and printed tone value and three assessment methods – scratch resistance, image visibility and run length.

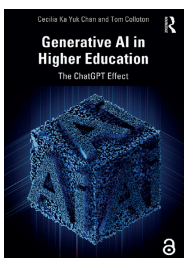
Bookshelf

Generative AI in Higher Education The ChatGPT Effect

This book deals with a topic that has recently become one of the most debated across various fields and in different contexts, with education being one of the highest priorities. The authors introduce artificial intelligence (AI), track the latest developments in generative AI, explain related concepts, and address individual aspects relevant to higher education to help readers embrace the potential of generative AI in this area.

The first chapter begins with definitions of AI and its three types, Big Data and the Internet of Things. Then, it focuses on generative AI and its applications, concerns and challenges, discussing ChatGPT by OpenAI as a ground-breaking tool in education. It also illustrates the way ChatGPT works and how images are generated from text. The second chapter highlights the importance of AI literacy as an integral part of general digital literacy today, as well as its distinctions in different professional contexts. It presents existing AI literacy frameworks, introduces the dynamic model for specific roles, elaborates on the definition of AI literacy for teachers, and identifies the advantages and disadvantages of developing AI literacy.

Three chapters explore the implications of generative AI for curriculum design, assessment and education policy. Based on the published research complemented by the extensive study of opinions of both students and teachers presented in online fora or direct discussions, the authors review the identified opportunities along with the current shortcomings and risks. The list of positive features includes user-centric design, humanistic conversational style, variability, multimodal capability, scalability, customisability, comprehensive coverage, contextual relevance, multilingual support, appropriateness of topics, and code generation. Some are, at the same time, weaknesses, such as variability inherently leading to less consistent output and complicating verifications. Potential threats are also connected with a decline in critical and creative thinking, in-depth understanding, and other competencies and skills, limited social interactions, resource and technical barriers, and, last but not least, ethical concerns. Combined with the insight into designing effective prompts and ChatGPT-4's capabilities to remember, understand, apply, analyse, evaluate and create, the authors provide examples of utilising generative AI in a wide range of activities from teaching to administrative tasks. Further, the strategies enhancing the effectiveness of assessments while preserving the integrity and nine categories of the assessment types suitable for AI integration are discussed in detail, together with approaches and tools for detecting AI-generated text. Similarly, ethical principles and AI-related concerns are analysed in the context of developing AI policy, with examples implemented around the world and recommendations specific to higher education. The last two chapters are dedicated to the technology behind generative AI, the state-of-the-art models and the future of AI in education.



Authors: Cecilia K. Y. Chan, Tom Colloton

Publisher: Routledge
1st ed., March 2024
ISBN: 978-1-03-259904-5
286 pages, 32 images
Softcover

Available also as an eBook



Innovative Technologies for Printing, Packaging and Digital Media

Editors: Huihui Song, Min Xu, Li Yang,
Linghao Zhang, Shu Yan

Publisher: Springer
1st ed., January 2024
ISBN: 978-9819999545
582 pages, 353 images
Hardcover
Also as an eBook



This volume includes a selection of over 70 peer-reviewed papers from the 14th China Academic Conference on Printing and Packaging held in Beijing in November 2023. In addition to the topics covered in previous years, from colour and image processing to printing, packaging and mechanical engineering to materials, this edition also deals with information engineering and artificial intelligent technology. The papers deal, for example, with colour measurement geometries for optically variable inks, highly precise detection of register error based on machine vision, numerically investigated spreading behaviour of inkjet droplets on rough substrates, 3D-printed micro-needle blood glucose sensor, food delivery boxes utilising phase change materials for thermal energy storage, fatigue life prediction analysis of the machete arm in web folding mechanism, electrochromic materials and devices, and intelligent package quality inspection system.

Textile Printing

Author: N. N. Mahapatra

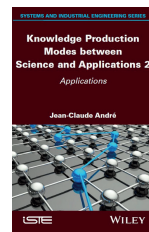
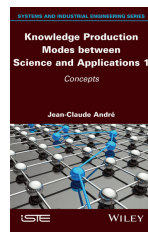
Publisher: CRC Press
1st ed., February 2024
ISBN: 978-1032630083
204 pages
Hardcover
Also as an eBook



After the introduction, the chapters of this book discuss direct printing, roller printing, resist printing, screen printing, discharge printing, block printing, digital textile printing, transfer printing, garment printing, and yarn printing (space dyeing).

Knowledge Production Modes between Science and Applications Volume 1: Concepts Volume 2: Applications

The main chapters of these two volumes are preceded by extensive sections of the preface, stressing the importance of innovations as a driver of general progress, and of the introduction, elucidating the author's background in the field of 3D, 4D and bioprinting, current conditions in the academic research and industry, especially in the French context, and various aspects affecting the chances to invent and transform the invention into innovation. The first volume discusses the factors and processes towards invention and then innovation, i.e. ideas and concepts, creativity, constraints, disruptions and crises, a proof of concept, innovation models, as well as the so-called valleys of death, the role of the rational framework, interdisciplinarity, heuristics, methodologies, innovation policies, and standardisation. The second volume begins with an in-depth account of socially responsible research and then focuses on 3D, 4D and bioprinting innovations and creativity in additive manufacturing. The concluding section provides the author's vision of research and emphasises that science must acknowledge its social responsibility.



Author: Jean-Claude André

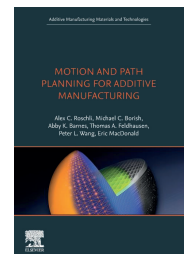
Publisher: Wiley-ISTE
1st ed., April & May 2024
ISBN: 978-1-786-30807-8 & 978-1-786-30935-8
288 & 272 pages
Hardcover
Available also as an eBook

Motion and Path Planning for Additive Manufacturing

This book provides background information on additive manufacturing, mechanical systems, kinematics, motion platforms, and kinematic arrangements, including robotic arm configurations with six degrees of freedom, as well as file formats for geometry data storage. Further, it describes the slicing process. It deals with cross-sectioning to define individual polygon layers and generating toolpaths for closed-loop contours of perimeters and insets, space-filling paths of infills and skins, open-loop paths (so-called skeletons), and the secondary paths providing support and assisting the process, e.g. by levelling the build plate and reducing first layer delamination. It also examines path modifiers to enhance the toolpath printability, the definition of path directions, ordering and connections, and toolpath considerations for thermoplastics, thermosets, and concrete. Further, it covers specifics of directed energy deposition processes, non-extrusion processes, off-axis and nonplanar slicing, five-axis systems with two rotary axes, and hybrid ad-

Authors: Alex C. Roschli, Michael C. Borish, Abby K. Barnes,
Thomas A. Feldhausen, Peter Wang, Eric MacDonald

Publisher: Elsevier
1st ed., November 2023
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296 pages
Softcover
Available also as an eBook



ditive manufacturing, combining both additive and subtractive processes. Then, it explains the purpose and contents of the g-code file with the commands controlling the 3D printer. Finally, it discusses next-generation slicing approaches, such as sensor feedback, slice-on-demand capabilities, g-code streaming, support and integration of simulations, and novel visualisation and interaction modalities, e.g. using augmented reality.

The Book of Colour Concepts

These two volumes in a slipcase are dedicated to the evolution of dealing with various aspects of colour in art, science, education, industry and other contexts between the years 1686 and 1963. The content builds on carefully collected and organised archival sources, from well-known charts and works to rare or forgotten records. The first volume begins with an introductory essay from A. Loske. Its four chapters deal with early charts and tables, circles, wheels and globes, the rise of colour theory, and nomenclatures and standards. In the introduction to the second volume, S. Lowengard discusses the materiality of colour concepts. Five chapters focus on the teaching of colour; the early 20th century, spiritualism, occultism and music, Eastern colour concepts, and Bauhaus and beyond. The hundreds of quality illustrations are complemented by texts in English, French, German and Spanish.



Editor: Alexandra Loske
Author: Sarah Lowengard

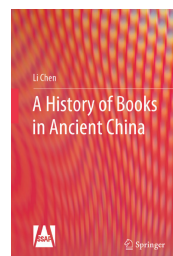
Publisher: Taschen
1st ed., March 2024
ISBN: 978-3-8365-9565-0
846 pages
Hardcover

A History of Books in Ancient China

To encompass Chinese book history in an accurate and comprehensive way, the study presented in this book analyses the development of ancient Chinese books in the context of changes in cultural, social, economic and political conditions in China and its regions across the vast time period of more than three thousand years, from the first inscriptions and later origins of Chinese book industry in dynasties before Confucius up to the 'New Culture Movement' in the 20th century. In eight chapters, the author describes and analyses the content, publishing, printing and collecting of books. The evolution of carriers and bindings of ancient Chinese books, from oracle bones to books with thread-stitched binding as the most mature form, is described in an appendix before the conclusion.

Author: Li Chen

Publisher: Springer
1st ed., May 2024
ISBN: 978-981-99-8939-3
476 pages, 70 images
Hardcover
Available also as an eBook



Digital Transformation in Design Processes and Practices

Editor: Laura S. Scherling



Publisher: Transcript
1st ed., June 2024
ISBN: 978-3837671421
298 pages
Softcover
Also as an eBook

The essays in the first part of this book discuss equitable processes and practices in digital design, including the importance of trust and trustworthiness, a range of ethical considerations, digital typography and its responsiveness to devices, physical spaces and cognition, the challenge of closing the digital divide, and also the trends in technology, such as the use of non-fungible tokens, design of virtual worlds, artificial intelligence utilisation and technological transformations in textile design. The second part includes case studies and interviews exploring the relationships between digital transformation, design and education. For example, E. Lupton points out changes in design education, the problems students face today and the support they need.

The International Politics of Logos of Logos, Colours, Symbols, Cues, and Identities

Authors: Matteo C. M. Casiraghi, Eugenio Cusumano



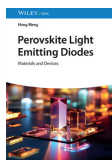
Publisher: Routledge
1st ed., December 2023
ISBN: 978-1032500171
178 pages, 46 images
Softcover
Also as an eBook

This book presents a systematic study of over two thousand logos of different types of organisations, from political parties to private military and security companies to terrorist groups, applying qualitative and quantitative analyses of the types of logos, colours, symbols and other features they use. The study also examines their regional differences and the changes over time.

Perovskite Light Emitting Diodes Materials and Devices

Author: Hong Meng

Publisher: Wiley-VCH
1st ed., January 2024
ISBN: 978-3527353200
368 pages
Hardcover
Also as an eBook



First, this book describes the structure and physical properties of metal halide perovskites, with a focus on luminescence and light-emitting diodes, and the methods and processes for their synthesis and preparation, including the use of printing. Then, it details different perovskite materials and devices emitting in near-infrared, red, green and blue spectral regions, together with specific fabrication and optimisation processes and effects of metal ion doping. It also covers lead-free metal halide perovskite materials, white light-emitting materials and devices, and electron and hole transport materials. Finally, it explores the stability of perovskite light-emitting diodes and various morphologies of perovskite lasers.

Tribological Aspects of Additive Manufacturing

*Editors: Rashi Tyagi,
Ranvijay Kumar, Nishant Ranjan*

Publisher: CRC Press
1st ed., April 2024
ISBN: 978-1032509754
252 pages
Hardcover
Also as an eBook



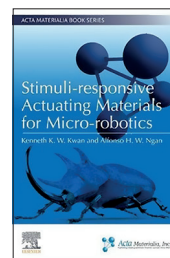
This book presents the studies of the tribological behaviour of additively manufactured materials and parts and the effects of types and parameters of the 3D printing process on wear, friction, and lubrication. It covers alloys, thermoplastic polymers, polymer-matrix composites reinforced with metal powder, carbon fibres or various natural fibres, tribocorrosion properties of orthopaedic implants, emerging applications of 3D-printed parts with enhanced tribological properties, and other applications.

Stimuli-responsive Actuating Materials for Micro-robotics

The authors present the stimuli-responsive materials and their use in micro-robotic devices as a solution closing the gap between conventional motors and actuators and nanorobots powered by molecular motors. The book describes piezoelectric ceramics, shape memory alloys, nanoporous metals, both electroactive and non-electroactive polymer actuators, polymer gels, carbon nanotubes, and graphene-based actuators. Also, it deals with novel actuating material types, including those based on transitional metal oxides and hydroxides, as well as carbides and nitrides (i.e. 2D materials called MXenes), and 2D MoS₂. Further, it discusses multi-material systems, such as hydraulically amplified self-healing electrostatic actuators, and additional robotic functions, e.g. compact actuation and sensing or energy generation, enabled by multi-stimuli-multi-response materials. One chapter describes the enabling technologies – fabrication processes, including 3D and 4D printing, special techniques for enhancing robotic functions, and chemo-mechanics analysis of actuators. Another one is dedicated to applications, namely bionic robotic fish and jellyfish, swimming robots, flying robots, terrestrial robots, delta and gripper robots, soft grippers, and surgical devices. The book concludes with a comparison of actuating materials and an outlook on future development.

Authors: Kenneth K. W. Kwan, Alfonso H. W. Ngan

Publisher: Elsevier
1st ed., February 2024
ISBN: 978-0-443-16094-3
302 pages
Softcover
Available also as an eBook



Smart and Connected Wearable Electronics Nanomanufacturing, Soft Packaging, and Healthcare Devices

The main content of this book, with almost 40 contributors, is organised into three parts. The first one deals with printing-enabled nanomanufacturing of sensors and electronics, with the chapters focused on screen printing, inkjet printing, aerosol jet printing and roll-to-roll printing. The second part describes soft material packaging for hybrid flexible bioelectronics. It details integration strategies, fabrication methods and materials, from substrates to interconnections to encapsulation, as well as materials and technologies suitable for human-machine interfaces. The applications of wearable electronics for healthcare devices, presented in the third part, include devices monitoring electrophysiological signals and gaseous biomarkers, implantable soft electronics and sensors, and powering technologies.

Editors: Woon-Hong Yeo, Yun Soung Kim

Publisher: Woodhead Publishing
1st ed., November 2023
ISBN: 978-0-323-99147-6
588 pages
Softcover
Available also as an eBook



Bookshelf

Academic dissertations

Chemical and Particulate Contaminants Produced in Additive Manufacturing (3D Printing) of Plastics

This thesis contributes to the research on additive manufacturing safety, which continues to gain importance with the significant growth in the use of both industrial and consumer-scale machines, while the associated occupational and operational hazards are not sufficiently explored and identified. Exposure to various contaminants can arise during all stages of the production process and also later during product use. This work is focused on gaseous or particulate air pollutants in polymer additive manufacturing. The aim was to document the exposure levels of identified agents and compare the obtained data with the known threshold values as well as among the individual additive manufacturing methods studied.

The dissertation provides the background on relevant additive manufacturing methods, including material extrusion, vat photopolymerisation, powder bed and multi-jet fusion and material jetting, along with the corresponding polymer materials, i.e. thermoplastic filaments and pellets, photocurable resins, powders and composites, as well as the monitored categories of indoor air pollutants, namely volatile organic compounds and particles classified as dust or coarse, fine and ultrafine. The review chapter concludes with the findings from the literature on 3D printer emissions for the methods of interest and essential exposure influencing factors. Two chapters detail the aims of the thesis and experimental methods used for sampling and analysis. The results show that the operation of all used 3D printers and feedstocks increases chemical or ultrafine particle concentrations, usually both. The values are mostly below the defined hazardous levels; however, for many detected compounds, the limits are not available. The results for sustainable and generic feedstocks were similar. Coarse particles exceeded the limits when handling powdered feedstocks in the pre- and post-processing stages. Similarly, post-production material outgassing was identified as a potential risk if products were not correctly post-processed and stored.

3D Printed Piezoelectric Energy Harvesters

This thesis explored the 3D printing of piezoelectric materials to provide a sustainable and highly stretchable energy source for wearable electronic systems. In particular, the approach was based on formulating the piezoelectric inks and combining two 3D printing techniques, digital light projection and direct writing, to fabricate the mechanical energy harvester comprising the composite piezoelectric material and electrodes. The design was further improved by implementing a kirigami and auxetic structures. The latter enabled the device to be used as a bending angle sensor thanks to the increased bending output voltage.

The text briefly reviews the principles of energy harvesting with a focus on harvesters based on piezoelectric effect, common types of piezoelectric materials, considerations for their 3D printing and fabricating stretchable piezoelectric energy harvester, including the benefits of kirigami patterns and various auxetic structures. One chapter provides the experimental details

Doctoral thesis – Summary

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ISBN: 978-952-61-4769-7

Doctoral thesis – Summary

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DOI: 10.32657/10356/166595

Doctoral thesis – Summary

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Tatiana Gambaryan-Roisman

Defended:
20 December 2023, Technical University of Darmstadt, Department of Mechanical Engineering, Institute of Printing Science and Technology Darmstadt, Germany

Language:
German

Original title:
Untersuchung der Lösungsmittelatmosphäre von verdunstenden, gedruckten Fluidfilmen mittels digitaler, holographischer Interferometrie

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felix.braig@googlemail.com

Further reading:
DOI: 10.26083/tuprints-00026632

regarding the selection of materials, preparation of inks and methods for fabrication of piezoelectric materials and electrodes. It also describes the methods used for the characterisation of materials and samples, together with simulations using the finite element method. Three chapters present the individual types of energy harvesters. First, the all-3D-printed stretchable piezoelectric nanogenerator was fabricated using ink with piezoelectric ceramic barium titanate nanoparticles and photocurable acrylate oligomers. The output voltage was improved by printing a staggered strip structure. The resulting sensor showed stretchability over 400 % and a large sensing range but low sensitivity; its performance was stable up to 100 % tensile strain. Second, the piezoelectric nanoparticles were incorporated in the poly(vinylidene fluoride-co-trifluoroethylene) matrix. The modified kirigami structure with a T-joint cut allowed the fabrication of the device to be suitable for wearable applications, including gait sensing, with strain up to 300 % without degradation in output voltage. Finally, the barium titanate nanoparticles were surface-modified to enhance piezoelectricity, ferroelectricity and dielectric constant of the composite. The additional 3D-printed auxetic structure enabled the generation of energy not only by pressing and stretching but also by bending.

Investigation of the Solvent Atmosphere of Evaporating Printed Liquid Films Using Digital Holographic Interferometry

The research within this thesis was concerned with the field of drying thin liquid films with a focus on the evaporation process and the possible ways of improving it. This knowledge can help to achieve higher homogeneity of printed layers, among other application areas. The approach was based on studying the spatial distribution of the solvent vapour in close proximity to the film surface, which reflects the local evaporation rates. Their differences lead to concentration gradients in the fluid film that can result in flows within the printed layer and, consequently, defects and other non-uniformities in the dried layer. The work employed the analysis of images acquired by an interferometric system. A six-axis robot and an inkjet printing system were used to ensure the required precision in the printing and manipulation of samples.

The dissertation introduces the basics of the inkjet printing process and the theoretical background on the evaporation of solvents, with the considerations of free enthalpy and saturation vapour pressure for pure fluids and binary liquid mixtures. Further, it covers mass transport in gases, including convective mass and heat transport and the fluid dynamic boundary layer theory, the numerical simulations used in the experimental design, the Fourier transform and its application to two-dimensional image data, and an overview of recent publications in the considered domain. The experimental details include the measurement concept, called digital holographic interferometry and based on changes in the refractive index of air above the evaporating film of ethylene glycol with ethanol, the setup comprising a Michelson interferometer, an inkjet printing unit and a robotic platform, the characterisation of the camera sensor, an experimental plan and the image analysis method, including the analysis of the reference images and interferograms, phase unwrapping, the concentration distribution calculations, and their limitations. Finally, the dissertation presents the spatial distribution and temporal evolution of ethanol vapour molar concentrations, allowing conclusions to be drawn about the vapour flow above the thin liquid film. It discusses the influences of the substrate inclination during evaporation and the width of the printed film, as well as the diffusion flux near the phase interface, temperature effects, and the evaluation at low solvent concentrations.

Events

Textile Printing & Sustainability Conference 2024



Düsseldorf-Neuss, Germany
15–16 October 2024

In its second edition, the programme of this ESMA event begins with two keynotes focused on the EU's Ecodesign for Sustainable Products Regulation (ESPR) and Digital Product Passport (DPP) requirements, as well as the role of safe chemicals, essential to the sustainability performance. The next two keynotes deal with polysaccharide-based screen-printing inks and the current challenges in education and training in the textile printing sector. On the second day, the keynotes cover the trends towards the circular digital textile and surface decoration industry, the progress in direct-to-film technology, the impact of fast or slow fashion on garment quality, the key principles of circularity, and the strategies supporting the environmentally responsible approach. Sustainability and digital transformation are also reflected in other contributions, together with new materials, hardware and software solutions and innovative processes.

American Printing History Association Annual Conference 2024



Printing History, Past, Present and Future
New York City, New York & Berkeley, California, USA
17–19 October 2024

The association celebrates its 50th anniversary with a special hybrid conference that combines two locations and virtual as well as in-person events, including a workshop, tours and presentation sessions. Among the keynotes, the intriguing topic, encompassing the printing history, specimen books and generative artificial intelligence struggling with text, is presented by Lisa Gitelman in her talk entitled 'Typographic hallucination, or, a conversation imagined between artificial intelligence and the printing trades'.

GRID 2024

12th International Symposium on Graphic Engineering and Design

Novi Sad, Serbia
14–16 November 2024



This edition features three plenary speakers. The keynotes of the first two focus on packaging – the topics are sustainable packaging solutions by Urška Vrabič Brodnjak and current trends in packaging by Emine Arman Kandirmaz. The title of the third keynote by Charles T. Weiss is 'Transforming the classroom with design thinking'. The following sessions are organised into two tracks, complemented by the industry session on the second day. On the last day, the symposium concludes with a round-table discussion. The numerous posters mostly deal with printing quality, digital media, novel technologies and artificial intelligence. In addition, they cover the topics of education, typography, design, packaging added value, ecology, paper as a substrate, and print finishing.

User Forum UV Printing 2024



Aschheim, Germany
5–6 November 2024

This event is held every two years, only in German. With the 2024 slogan 'LED the future start!', the 13th edition presents various radiation curing applications, from offset lithography and inkjet printing to metal decorating and 3D screen printing. The topics also cover differences in curing technologies, including electron-beam curing and initiator-free UV curing, environmental aspects, such as deinkability and food contact safety, materials, and more.

ICGIP 2024

16th International Conference on Graphics and Image Processing



Nanjing, China
8–10 November 2024

The programme of this established event includes, for example, a keynote by Mingyi He on 'Integrated image and graphic intelligent processing via hyperspectral multi-viewing' and papers presenting the improved handwriting recognition, calligraphic guideline generation, matching and fusion of visible and infrared images, 3D texture generation, a text-to-image customisation method for image generation, and enhanced reversible data hiding in encrypted images.

XIX Color Conference

<https://www.gruppodelcolore.org>
28–29 November 2024

The 2024 edition of this conference is in online format. The invited speakers are Phil Green, presenting a test chart for seven-colour printing, Vien Cheung, discussing colour association, and Robin Kingsburgh, sharing her experience in teaching a multidisciplinary course about colour.

34th International Publishers Congress

Guadalajara, Mexico
3–6 December 2024



The programme of this edition includes panel discussions on how copyright promotes freedom of expression, the opt-out mechanism for rights holders to restrict the use of their work for text and data mining, the role of trustworthy publishing in the age of fake news and deepfakes, and more.

The 2025 C!print Shows



In 2025, these shows dedicated to visual communication, printing, and personalisation take place in both locations: first in Madrid, Spain (14–16 January) and three weeks later in Lyon, France (4–6 February).

GWG Technical Meetings in 2025

The first technical meeting of the Ghent Workgroup in 2025 takes place on 22–23 January in Lisbon, Portugal, and is preceded by the educational day at ISEC Lisboa, the Higher Institute of Education and Sciences, on 21 January. The second educational day is announced for 13 May at Artevelde University of Applied Sciences in Ghent before the meeting in Merelbeke, Belgium (14–15 May). The third meeting is scheduled for 15–16 October in Orlando, Florida, USA.



Convertech 2025

Tokyo, Japan
29–31 January 2025



This converging technology exhibition is organised jointly with those showcasing new value-generating functional materials, environmentally friendly materials and equipment, and decoration technologies.

SPIE Photonics West 2025

SPIE. PHOTONICS WEST San Francisco, California, USA
25–30 January 2025

This large event features over a hundred conferences with about five thousand presentations, comprising plenary and invited talks, technical papers, and posters; also, it offers tens of courses, industry demonstrations, and other learning or networking opportunities. The dozens of contributions that present various applications of printing are part of the programme of several conferences. The papers deal, for example, with a unique volumetric 3D printing technology for producing isotropic objects with optical-grade surfaces and other advances in volumetric 3D printing, 4D microprinting of programmable liquid crystal microstructures, 3D laser printing below the diffraction limit, optimising projection multi-photon 3D printing using convolutional neural networks, miniaturisable printed microfluidics employing the chemiluminescent reaction, as well as with novel materials and studies of physical and chemical processes underlying further development. The conference is accompanied by three exhibitions. In addition, Photonics West is co-located with the event dedicated to augmented, virtual and mixed reality, SPIE AR | VR | MR 2025, and SPIE Global Business Forum 2025, providing the market data and trends impacting the global photonics industry.

Electronic Imaging 2025

Burlingame, California USA
2–6 February 2025



For its current edition, this IS&T symposium joins 17 conferences that cover topics from human perception and cognition to media security and high-performance imaging. The announced keynotes are 'Transparency and scission in augmented reality' by Michael J. Murdoch, 'Experiencing art – changing the world to the better' by Claus-Christian Carbon, 'Predicting visible differences in virtual and augmented reality' by Alexandre Chapiro, 'Beyond the screen plane: stereo at Walt Disney Animation Studios' by Katie Fico, and the last by Daniel J. Sandin, reviewing five decades of innovation in interactive electronic displays for art and science at two U.S. universities. Of the 18 short courses, half are new, such as the one that teaches the use of Unity for perceptual and behavioural experiments in virtual reality.

innolAE 2025 Innovations in Large-Area Electronics

Cambridge, UK
17–20 February 2025



In its 11th year, this event begins with five short courses scheduled for the first two days. The programme of the following conference offers presentation sessions in two tracks, including several invited talks, and three plenary keynotes: 'On-chip learning with organic neuromorphic and biohybrid systems' by Yoeri van de Burgt, 'Lowering the barrier to entry for flexible foundry technology' by David Verity and 'Manufacturing organic semiconductors enabling high performance large area organic photovoltaics' by François Grenier.