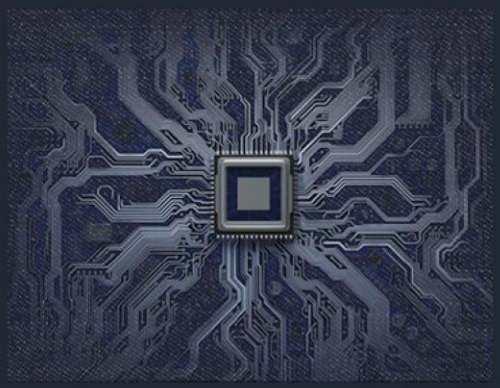

8th- 10th November 2022

E-Textiles 2022

International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles

Nottingham, UK

Conference sponsors

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E-Textiles Network

E-textiles 2022

4th International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles

E-textiles 2022: 4th International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles is an annual conference run by the E-Textiles Network, and is now in it's forth year. The conference brings together researchers and developers from academia and industry interested in adding electronic functionality to textiles and their related products. Topics this year will include:

- Applications and Future Trends
- Sensing and Embedded Systems
- Manufacturing and Standards
- Reliability and Sustainability
- Design and Fashion
- Immersive Technologies

The conference this year includes two keynote speakers, eight invited speakers, and twelve accepted talks from speakers from both academia and industry. The conference also hosts a poster session and exhibition stands.

We are happy to announce that MDPI Micromachines have agreed to sponsor three prizes at this year's conference including a best paper award, and best student paper award, and a best student poster award. Extended abstracts will be published in *MDPI Engineering Proceedings* and there will be an opportunity for participants of the conference to also submit work to a special issue of *MDPI Micromachines*.

We would like to thank both the Technical Programme Committee and International Steering Committee. We would also like to thank our exhibitors and the three sponsors of this year's conference Softmatter, MDPI Micromachines, and MTIF.

We hope that you find this year's conference interesting and insightful.

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Keynote and invited speakers

Jun Chen – *Keynote Speaker*

Assistant Professor in the Department of Bioengineering at the University of California, Los Angeles (USA)

Smart Textiles for Personalized Health Care

There is nothing more personal than healthcare. Health care should move from its current reactive and disease-centric system to a personalized, predictive, preventative, and participatory model with a focus on disease prevention and health promotion. As the world marches into the era of the Internet of Things (IoT) and 5G wireless, technology renovation enables the industry to offer a more individually tailored approach to healthcare with better health outcomes, higher quality, and lower cost. However, empowering the utility of IoT-enabled technologies for personalized health care is still significantly challenged by the shortage of cost-effective on-body biomedical devices to continuously provide real-time, patient-generated health data. Textiles have been concomitant and played a vital role in the long history of human civilization. Incorporating sensing and therapeutic capabilities into everyday textiles could be a powerful approach to the development of personalized healthcare. Merging biomedical devices and textiles becomes increasingly important owing to the growing trend of IoT since it could serve as on-body healthcare platforms with incomparable wearing comfort. In this talk, I will introduce our current research on smart textiles for biomonitoring, therapeutics, power supply, and textiles body area network for personalized health care.

Martin Ashby – *Keynote Speaker*

Chief Innovation Officer, Prevayl Limited (UK)

The Challenges of Bringing Garment Based e-Textiles to the Mass Consumer Market

There is an inevitable trade-off that wearable tech companies have to wrestle with when trying to meet the demands of a mass market consumer: the consumer expects the product to be highly accurate, offer empowering insight, look like an ordinary garment and be priced affordably. So far, the trade-off has not worked and a product hasn't been delivered. The talk will raise some of the challenges we must all address if the e-Textiles sector is to achieve its growth potential.

Keynote and invited speakers

John Ho – *Invited Speaker*

Associate Professor in the Department of Electrical and Computer Engineering at the National University of Singapore

Wireless Connectivity with Wearable Metamaterials

Wireless technologies underlie the connectivity that is the hallmark of modern life. Textiles are adopted by all societies, cover most of the body, and are present in all of our daily lives. Could textiles be used to provide new forms of connectivity for sensing and interaction with the human body? This talk will describe our recent work on wirelessly functional textiles that interact with the user through technologies such as Bluetooth, Wi-Fi, and NFC. Using the electronic textile toolkit, we show that clothing can be designed to boost wireless signals between wearable devices, power battery-free sensors around the body, and sense changes in the wireless environment, all without any physical connections between clothing and technology.

Michael Schneider– *Invited Speaker*

Managing Director, BORN (Germany)

Production of E-Textiles – Challenges & Best Practice

The production or manufacturing of Smart Textiles is seriously different from the previous methods of textile production. This is where two worlds meet. This means that textile producers must be open to new production methods and processes and machines. Much more than ever before, a very close interaction with the customer is necessary already in the development phase to achieve the best product. In addition, there are new norms and standards as well as certifications that must be adhered to on the part of developers and producers. In this presentation we share our experience from the last years as well as our best-practice we have learned from it.

Keynote and invited speakers

Chris Jorgensen– *Invited Speaker*

Director, Technology Transfer, IPC (USA)

How the Global E-Textiles Industry Is Addressing Reliability of Product Through Open International Standards

As the markets for e-textiles continues to expand, so too will the need for established standards for demonstrating reliability and reproducibility of product. These standards not only need to address the various integration technologies for e-textiles – woven, knitted, braided, embroidered, printed, etc. – but they will also need to be usable across product types – wearable, automotive, industrial, etc. – and market areas – defense, medical, consumer, etc.

In this presentation, Chris Jorgensen, staff liaison for the IPC E-Textiles Committee, will discuss how hundreds of volunteers from the global e-textiles industry are developing open international standards to meet these needs. He will also explain importance of open international standards, how they are developed, the cost-saving benefits they have to industry, how they improve reliability and speed time to market, as well as dispel some myths regarding standards.

Specific to their work, Chris will spotlight several key committee undertakings:

- How one committee has established generic classifications of e-textiles wearables products to benefit industry
- New Test Methods under development and how they will ensure consistent reliability testing from base e-textile to e-textiles wearables system, including washability
- Test standard for conductive yarns to build a library of standards-based specification sheets

New activities for embroidered e-textiles

Additionally, Chris will discuss IPC's Factory of the Future initiative and how activities there involving Digital Twin, Model-Based Definitions for Digital Twin, Cybersecurity in Manufacturing, Traceability, Connected Factory will benefit the e-textiles industry as it expands to next-generation manufacturing of next-generation product.

Keynote and invited speakers

Marina Toeters – ***Invited speaker***
Fashion Tech Designer, by-wire.net (The Netherlands)
Unfolding Fashion Tech: About Prettiness, Medical Goods, Technicalities, Usability and Business

The fashion industry is famous for their ability to let consumers desire to change. However, the last material innovation widely accepted by the fashion industry is from 1953. If the vogue world would gospel innovation and collaboration 'for the better' they can make a huge change in just 3 seasons. Garments can support the wearer: E-fashion starts caring for us! Current E-fashion projects are mainly about research and show that it is possible to advance fashionable garments. It isn't widely accepted and commercial yet. Marina will show and discuss how she tries to innovate the fashion industry via 3 approaches.

1) Fashion Tech product design: Via prototyping and an iterative research-through-design she supports for example Bilihome (www.bilihome.org) to develop a romper that enables jaundice therapy for newborns. For another project the Dutch government asked Marina to develop sustainable alternatives for medical gowns. Therefore her team developed Caring Clothing Tech, a product service system including UV-C disinfection that can be adopted by hospitals. The high quality gown reduces the current environmental impact of disposable gowns by over 90%. One locally made reusable gown replaces 400 disposables, which ultimately results in cost savings (www.by-wire.net/cct). Next to that Marina works a lot with printed electronics; Closed Loop Smart Athleisure Fashion, (www.by-wire.net/clsaf) is a good example of this.

2) Eco system creation: Marina started the shared working space Fashion Tech Farm to support and incubate fashion technologists, experimenting in this space about how the production facility can be designed so that it supports the local community by offering personalized, on the spot produced, innovative fashion for them. As the city of Eindhoven is developing into an ecosystem for complex design practice Marina just became one of the Design Ambassadors of the city of Eindhoven and strengthens the links between the tech and the design community.

3) Education and communication: Marina has a vision on how the fashion world could be and spreads this message in a wide variety of communities. During the presentation Marina will give examples of activities at the Lopec Printed Electronics fair, the VIBE museum experience last spring in Barcelona, coaching two groups on integrating technology in fashion and business development within WORTH and presenting sustainable approaches during the fabric fair Modtissimo in Porto.

Keynote and invited speakers

Strahinja Dosen – *Invited speaker*
Full Professor in Rehabilitation Robotics, Aalborg University (Denmark)
Textile electrodes for practical application of myoelectric control in human-machine interfacing

Myoelectric control is an attractive approach for human-machine interfacing, as it enables recognizing wrist and hand gestures and translating those into commands for an external device, without the need for placing the sensors on the hand. However, the biggest challenge to the wider use of this approach is that the state-of-the-art systems are not convenient for practical applications. The laboratory solutions provide high resolution and excellent signal quality, but require preparation (e.g., cleaning the skin and applying gel), while commercially available systems for dry recording are bulky and integrate a small number of recording channels. In the present lecture, we will describe textile interfaces developed within the EU-funded project Wearplex in an effort to overcome the critical barrier to the practical application of myoelectric interfacing. They integrate a matrix of recording pads for high-fidelity recording within an ergonomic textile sleeve that is easy to apply (gel not required) by wrapping it around the forearm. We will show the electrical and functional characterization of the interface as well as its potential clinical applications.

Elina Ilén – *Invited speaker*
Professor, Universitat Politècnica de Catalunya, BarcelonaTech (Spain)
Longevity and End-of-Use Aspects of E-Textile Application

The textile and electronics industries are both well-known as one of the most polluting industries in the world. E- textiles combine both industries aiming for high value-added products for instance to improve user's wellbeing and safety. Even though e-textiles have been a hot topic over two decades which can even save user's lives, less research and concern are stressed to the longevity and end-of-use aspects of those products. The presentation comprehensively discusses the state of art of longevity and reviews the end-of-use aspects in current e-textile research. It also discusses the different integration levels of electronics with textiles and how that relates to resource wise usage of materials and recyclability of the end-product. It highlights the challenges in developing more sustainable and longer lasting e-textile applications but also provides considerations for the researchers, how to tackle these challenges better in the future. The presentation uses the case example of sun powered textile application in concretizing the context of longevity and end-of-use or e-textiles.

Other invited speakers

The E-textiles 2022 organising committee are pleased to confirm the following additional invited speakers.

Sarah Goodchild (Defence Science and Technology Laboratory) - *Invited speaker*
Talk title: ***Wearable Technologies for Defence – Opportunities and Challenges***
Andrei Pyko (Teslasuit) - *Invited speaker*
Talk title: ***Smart Clothing to Improve Quality of Life, Health, and Physical Skills of People***

Conference Programme: Tuesday 8th November 2022

Time	Title
15:00-16:00	Tours of the Nottingham School of Art and Design
16:00-18:00	E-textiles in Action
18:00-20:00	Talk on E-textiles research at Nottingham Trent University and drinks reception

Conference Programme: Wednesday 9th November 2022

Time	Title	Session chair(s)
	Opening session	
09:30-09:45	Opening address by Jake Kaner (Associate Dean for Research of the Nottingham School of Art and Design, Nottingham Trent University)	Theodore Hughes-Riley
09:45-10:20	**The Challenges of Bringing Garment Based e-Textiles to the Mass Consumer Market** Keynote speaker - *Martin Ashby (Prevayl)*	
10:20-10:50	Exhibitor elevator pitches	
10:50-11:10	Coffee break	
	Sensing and embedded systems session	
11:10-11:40	**Wireless Connectivity with Wearable Metamaterials** Invited speaker - *John Ho (National University of Singapore)* [Remote presentation]	Jun Chen
11:40-12:00	**Stress Detection by Using Textile Heat Flux Sensor** *Gidik Hayriye (Junia Hei)*	
12:00-12:20	**Novel strain sensor in knitted textile for functional electrical stimulation** *Bahareh Abtahi (Institute of Textile Machinery and High Performance Material Technology (ITM) Dresden)*	
12:20-13:20	Lunch	
	Applications and future trends session	
13:20-13:50	**Wearable Technologies for Defence – Opportunities and Challenges** Invited speaker - *Sarah Goodchild (Defence Science and Technology Laboratory)*	Pasindu Lugoda
13:50-14:10	**E-knits for bio-signal recordings** *Kristel Fobelets (Imperial College London)*	
14:10-14:30	**New Frontiers in Advanced Fibers and Fabrics** *Michelle Farrington (Advanced Functional Fabrics of America)*	
14:30-14:50	Coffee break	
14:50-15:40	Panel discussion on '**Applications and future trends for E-textiles**' *Sarah Goodchild, Marina Toeters, Martin Ashby*	Barbara Shepherd
	Poster session	
15:40-17:00	Poster elevator pitches	Theodore Hughes-Riley
17:00-18:00	Poster viewing session	
19:00-23:00	Optional conference meal	

Conference Programme: Thursday 10th November 2022

Time	Title	Session chair(s)
	Keynote session	
09:00-09:35	**Smart Textiles for Personalized Health Care** Keynote speaker - *Jun Chen (UCLA)*	Yang Wei
09:35-09:55	Coffee break	
	Manufacturing and standards session	
09:55-10:25	**Production of E-Textiles – Challenges & Best Practice** Invited speaker - *Michael Schneider (BORN GmbH Germany)*	Malte von Krshiwoblozki, Prof. George Stylios
10:25-10:45	**Direct Wet-Spun Single-Walled Carbon Nanotubes-Based p-n Segmented Filaments toward Wearable Thermoelectric Textiles** *Xiaona Yang (Donghua University) [Remote presentation]*	
10:45-11:05	**Developing high-resolution thin-film microcircuits on textiles** *Abiodun Komolafe (University of Southampton)*	
11:05-11:35	**How the Global E-Textiles Industry Is Addressing Reliability of Product Through Open International Standards** Invited speaker - *Chris Jorgensen (IPC)*	
11:35-11:55	Coffee break	
	Reliability and sustainability session	
11:55-12:25	**Longevity and End-of-Use Aspects of E-Textile Applications** Invited speaker - *Elina Ilén (Universitat Politècnica de Catalunya, Barcelona Tech.)*	Jesse Jur, Russel Torah
12:25-12:45	**Tuneable carbon nanotube conductive inks for an effective textile based respiratory sensor system** *Hulya Cebeci (Istanbul Technical University Aerospace Research Center) [Remote presentation]*	
12:45-13:05	**Measuring the flex life of conductive yarns in narrow fabric** *Paula Veske (Gent University)*	
13:05-14:15	Lunch	
	Design and fashion session	
14:15-14:45	**Unfolding Fashion Tech: About Prettiness, Medical Goods, Technicalities, Usability and Business** Invited speaker - *Marina Toeters (Eindhoven University of Technology)*	Steve Beeby
14:45-15:05	**What would you be willing to wear to monitor your risk of a fall?** *Rachael Wickenden and Zahra Rahemtulla (Nottingham Trent University)*	
15:05-15:25	**Re-FREAM Second Skins** *Malou Beemer (Atelier Mlou)*	
15:25-15:45	Coffee break	
	Immersive technologies session	
15:45-16:15	**Textile electrodes for practical application of myoelectric control in human-machine interfacing** Invited speaker –*Strahinja Dosen (Aalborg University)* [Remote presentation]	Kai Yang, Mili Tharakan
16:15-16:35	**The Machine Learning Empowered Gesture Recognition Glove** *Kun Zhang (Donghua University)* [Remote presentation]	
16:35-16:55	**Shape memory polymers for the design and development of smart responsive clothing** *Hema Garg (Indian Institute of Technology)*	
16:55-17:25	**Smart Clothing to Improve Quality of Life, Health, and Physical Skills of People** Invited speaker – *Andrei Pyko (Teslasuit)*	
	Closing session	
17:25-17:30	Closing address and poster prize award	Yang Wei

Conference sponsors

Softmatter

Softmatter: Transforming the future of wearable technology through textile integration

Softmatter is a leading global wearable technology company dedicated to solving the toughest smart soft goods engineering challenges. We enable our customers to interpret the world around us by intelligently bridging the smart with the soft with unmatched technologies that empower and connect.

Our dynamic team has industry-leading expertise in smart textiles, from design to manufacture. By partnering with an experienced team, you can:
+ Design and build from concept to production.
+ Solve unprecedented regulatory challenges while accelerating time to market.
+ Quality commitment of ISO 9001 and 13485 facilities with FDA Class I and II products in execution.

We also offer a range of 'Developer Kits' with electronic components, designed for making product-like prototypes, that can be seamlessly integrated into solutions.

We help you strategically enhance your offering so that it has a profound, global impact. Interested in enabling your idea? Learn more at www.softmatter.io or reach out to us at softmatter@masholdings.com

Check out the QR code to purchase Softmatter's developer toolkits:

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The Medical Technologies Innovation Facility (MTIF)

The Medical Technologies Innovation Facility (MTIF) is a pioneering, research and development facility, which supports academic and industry organisations in accelerating Medtech innovation development from bench to bedside. MTIF is proud to offer access to specialist services, equipment, sector-leading expertise, and state-of-the-art facilities and our focus, alongside our partners, is to deliver a fully integrated capability to support the end-to-end development of innovative products and therapies. Improving patients' lives by providing revolutionary product development to organisations developing Medtech. Whatever the scale of your project, MTIF can work, guide and support you, from initial idea to finished product.

Micromachines

E-Textiles 2022 are pleased to announce that MDPI Micromachines have agreed to sponsor three prizes at this year's conference:

1. Best Paper Award £410
2. Best Student Paper Award £205
3. Best Student Poster Award £205

Prizes will be issued as an Amazon gift card and will be sent to the winners after the conclusion of the conference.

Accepted authors will also have the opportunity to submit a full paper for publication in a Special Issue of Micromachines (2000 CHF publishing fee applies). Micromachines is a peer-reviewed, open access journal on the science and technology of small structures, devices and systems, published monthly online by MDPI.

Venue and directions

Nottingham Conference Centre, 30 Burton Street, Nottingham NG1 4BU

The conference centre is located near the centre of Nottingham on the city campus of Nottingham Trent University. There is parking nearby and easy access via public transport (the centre is near the Nottingham Trent University tram stop).

Full directions are available here:
https://nottinghamconferencecentre.co.uk/write/MediaUploads/5614_NCC_map.pdf

E-Textiles Network

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