

# Editorial to the First Issue of the Second Year

**W**ELCOME to the second year of a very successful launch of the new IEEE JOURNAL ON FLEXIBLE ELECTRONICS (J-FLEX), a joint publication of the IEEE Sensors Council (SC), the IEEE Electron Device Society (EDS), and the IEEE Circuits and Systems Society (CASS). I am proud to announce the publication of the first of six issues within volume 2, in concert with the J-FLEX Steering Committee and Editorial Board. Without the community's support, which has been overwhelming, J-FLEX's growing popularity would not have been possible.

Together, Ravinder Dahiya, of SC, and myself, of EDS, co-founded J-FLEX in 2021. Ravinder was our seminal Editor-in-Chief for four issues in Volume 1 (2022), while I was the Associate Editor-in-Chief, helping build out this new vision, including its look and artwork. Ravinder now steps down as Editor-in-Chief. It is with great pleasure that I take over as Editor-in-Chief (2023–2024) for the next two years: Volume 2 (six issues) and Volume 3 (12 issues). I wish to thank Ravinder for his effort in helping build out this new IEEE journal. I also wish to thank you all, our authors, our readers, and particularly our seminal editorial board for all their hard work and contributions. Soon we will be codifying an expansion of our editorial team, so stay tuned.

Four issues were published in Volume 1 (2022) with a series of eye catching cover art images that captures the flavor of our flexible electronics community, such as artificial retinas [1] and wearable heart monitoring [2]. Our J-FLEX signature image appeared on the cover of the first J-FLEX issue,<sup>1</sup> illustrating how flexible electronics has the world in its hands, covering medical wearables, healthcare, shopping, inventory control, transportation, communication with the cloud, while being self-powered, sometimes through energy scavenging. This is just a snippet of its potential ecosystem and is not intended to be an exclusive list!

J-FLEX aims to publish cutting-edge research covering all aspects of sensors, transistors, related devices, circuits, systems on flexible, disposable, stretchable, and degradable substrates. This includes various functional and sustainable materials, material-integrated sensing, interface subsystems, corresponding actuators, energy harvesting, energy storage devices, modelling, simulation, manufacturing, integration or packaging in soft and flexible substrates, and all applications of flexible electronics. Topics such as 3-D printed or heterogenous integration, use of sustainable materials and processes aligned with circular economy are also in the scope of this journal. The journal aspires to serve as an international

forum for the topics within its scope and disseminate the results validating scientific and engineering excellence.

J-FLEX is a new venue for IEEE centric work on flexible electronics, meaning there is a closer attention to repeatability and reliability, with tendrils to industry and manufacturability. Therefore, my hope is that J-FLEX is a venue to validate future technologies in the marketplace.

A number of special issues are slated for the coming months. First, I want to call your attention to forthcoming special issues that are expanded papers of selected conference abstracts from our flagship IEEE flexible electronics conferences: FLEPS, hosted by the SC, and IFETC, hosted by the EDS. Both these conferences are very vibrant and capture a wide range of work in the field of flexible electronics.

Another forthcoming Special Issue details Flexible Electronics for Emerging Markets and Developing Economies.<sup>2</sup> This is one place where flexible electronics can transcend traditional electronics by lowering costs and enhancing availability through printing styles for mass production. It is here that successful technology development can lead to a maximum impact to humanity.

Also forthcoming are Special Issues on Self-Powered Sensors and Wearable Electronic System<sup>3</sup> and Neuromorphic Devices and Circuits for Next Generation Flexible Electronics,<sup>4</sup> both of which I have extended their deadlines. Wearable Sensors has been extended to July 31, 2023, and Neuromorphics has been extended to November 30, 2023. Thus, it is not too late to consider your own submissions!

In this issue, we have highlighted the work of Conti et al. [A1] on this issue's cover art, representing their work on a hybrid flexible near-field communication (NFC) sensor on paper, showing the fusion of solution processed and conventional silicon technology for a combination of strain and pH sensors with a humidity detector. This is highly illustrative of the potential of medical wearables.

Also in this issue, the second article by Portilla et al. [A2] details speed and scalability of ambipolar printed carbon nanotube thin-film transistors (CNT-TFTs) for ultra-low static power dissipation (1 pW) using CMOS-like circuits. Propagation delays of  $\leq 1$  ms per NOT logic gate were possible with ultra-low supply voltages of 0.2 V.

The third article by Déprès et al. [A3] addresses the end-of-lifecycle issues for electronic waste as the Internet-of-Things (IoT) explodes. Recycling of smart labels using a classic paper

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<sup>1</sup><https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9645763>

<sup>2</sup><https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9946930>

<sup>3</sup><https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9946935>

<sup>4</sup><https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9946928>

recycling chain indicated that up to 63% of printed material could be recovered in a conventional paper recycling chain. Thus, paper-based flexible electronics will positively affect sustainability.

The fourth article by Zulfiqar et al. [A4] also addresses end-of-lifecycle issues regarding wireless human-machine interfaces, particularly keyboards. Using graphite-on-paper keypads opens the possibility of a circular economy, mitigating electronic and plastic e-waste for a greener economy.

The fifth article by Nabavi [A5] illustrates the ability to reduce power consumption of organic light-emitting diodes (OLEDs) by reducing ohmic-losses by nearly 2.5 times, leading to greater than 4-fold increase in luminance. Subsequently, the team demonstrates its usage for photoplethysmography (PPG) to detect blood circulation through a skin-mounted flexible sensor system.

J-FLEX owes tremendous thanks to a variety of contributing people hidden behind the scenes. First, thanks are due to the J-FLEX Steering Committee, representing our financial sponsors, SC, EDS, and CASS, for supporting this journal both fully and patiently. Sincere thanks is especially due to Peter Willett, the J-FLEX Mentor from the IEEE Periodicals Committee for providing sage advice at every stage. Thanks are also due to the IEEE Production Team that helped us establish an artistic flare. Most of all, thanks are due to my editorial colleagues, Ravinder Dahiya (former Editor-in-Chief) and members of the Editorial Team, who have so generously given their time and expertise to launch this new journal. Their professionalism and attention to detail has built our strong teamwork. Last, but not least, I wish to thank the J-FLEX Admin Support Staff. Although John Wright is now rotating off J-FLEX, his effort and dedication ensured a professional product through his continuous support ensuring the timely completion of various administrative tasks. We now welcome Mansi Kukreti, and her supervisor Heather Malloy, for establishing a work ethic rooted in excellence for 2023 and beyond for J-FLEX's future.

The launch of a new journal comes from a long process and we took all the necessary steps to make it a high-caliber scientific publication. We are relying on the collaboration of all our authors, reviewers, and editors to make J-FLEX the key central archival repository of the burgeoning flexible electronics community. I hope that you enjoy reading this issue and that you feel a compunction to return again and again as a future reader and contributor, stimulated by the J-FLEX content.

I invite you to submit your best articles for publication. I would like to emphasize that J-FLEX publishes regular papers (up to eight pages), review papers (up to 20 pages), and expanded papers from selected conferences. In addition, we are always interested to review proposals for future special issues. Currently, we are developing a new Special Issue on Thin Film Transistors (TFT) in celebration of the 75th Anniversary of the Transistor and the passing of Gordon Moore. Stay tuned.

Please follow us on social media too (LinkedIn, Twitter, etc.) for updates and announcements.

With my sincere regards.

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and Editor-in-Chief*  
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- [2] J. Liu et al., "Stretchable textile bands for ambulatory electrocardiogram and oximetry," *IEEE J. Flexible Electron.*, vol. 1, no. 4, pp. 214–222, Oct. 2022, doi: [10.1109/JFLEX.2022.3220138](https://doi.org/10.1109/JFLEX.2022.3220138).

#### APPENDIX: RELATED ARTICLES

- [A1] S. Conti et al., "Hybrid flexible NFC sensor on paper," *IEEE J. Flexible Electron.*, vol. 2, no. 1, pp. 4–10, Jan. 2023, doi: [10.1109/JFLEX.2023.3238682](https://doi.org/10.1109/JFLEX.2023.3238682).
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- [A3] G. Déprès et al., "Recycling of paper electronics in standard paper and board recycling lines (2022)," *IEEE J. Flexible Electron.*, vol. 2, no. 1, pp. 18–24, Jan. 2023, doi: [10.1109/JFLEX.2023.3243586](https://doi.org/10.1109/JFLEX.2023.3243586).
- [A4] M. H. Zulfiqar et al., "Customizable graphite-on-paper based keypads: Toward disposable and recyclable wireless human-machine interfaces," *IEEE J. Flexible Electron.*, vol. 2, no. 1, pp. 25–33, Jan. 2023, doi: [10.1109/JFLEX.2023.3258914](https://doi.org/10.1109/JFLEX.2023.3258914).
- [A5] S. Nabavi et al., "Low-power organic LED fabricated by a novel solution-based process for photoplethysmography sensing," *IEEE J. Flexible Electron.*, vol. 2, no. 1, pp. 34–42, Jan. 2023, doi: [10.1109/JFLEX.2023.3259384](https://doi.org/10.1109/JFLEX.2023.3259384).