



Feeding Innovation and Creativity

One of the main qualities of the IEEE Industrial Electronics Society (IES) is to be at the crossroads between information and energy technologies. This characteristic makes our Society a great place for innovation. Its 24 technical committees, gathered in four clusters, are replete with talented individuals who are experts in their field. In such a buoyant context, your magazine, through the articles it offers, promises to feed the creativity of each of you, both readers and authors.

Indeed, what could be more satisfying for the reader who is not familiar with the topic covered by an article than being able, after reading it, to catch the basics, the current challenges, and the ways to afford them? What could be more stimulating for expert readers than finding an interesting reformulation of the basics that will help them to revisit their own knowledge under a new perspective, and of course, being inspired by the “Future Trends” section of the article? Last but not least, what could be more enjoyable for the authors, who knew how to solve the difficult problem and how to write an article that has to be at the same time accessible and inspiring, than feeling themselves creatively regenerated by this exercise? This last experience is really unique, and that’s why I strongly encourage you to experiment by writing your own article for *IEEE Industrial Electronics Magazine (IEM)*. To be fully convinced, just open this issue devoted to motors and

generators: new applications, innovations in control, and design.

We first start by introducing two new exciting applications of electric motors for a better world. In “Next-Generation Cryo-Electric Hydrogen-Powered Aviation,” J. K. Nøland et al. [A1] explore the forthcoming disruptive technological developments to achieve zero-emission aviation in 2035. It is shown how a next-generation H₂-powered aircraft could take advantage of onboard cryogenic fuels to cool the electrical components, enabling a cryo-electric superconducting drivetrain with amazing performance. The other application concerns a powered exoskeleton for assisting patients with paraplegia. J. Choi et al. [A2] describe the “The History and Future of the WalkON Suit: A Powered Exoskeleton for People With Disabilities.” The WalkON suit, which won the Cyathlon race in 2020, contains a lot of innovative technologies in actuation systems and control.

The next two articles focus on control and diagnostics, respectively. In the “The Evolution of Model Predictive Control in Multiphase Electric Drives: A Growing Field of Research,” M. J. Duran et al. [A3] present the continuous improvements during the last decade of finite-control set model predictive control for multiphase machines, thanks to the concept of virtual voltage vectors, which brings it to the same quality

level of performance at a steady state as field-oriented control strategies. In “The Commercialization of Medium-Voltage Induction Motor Rotor Diagnostics Equipment” S. B. Lee et al. [A4] relate the fruitful result of a five-year collaborative work among three independent parties: the equipment end user; the equipment designer; and a university research group. Thanks to their conjoined efforts, a robust diagnostic system based on the frequen-

cy signature analysis of the starting currents has been designed and successfully implemented in a fleet of induction motors of a large steel mill.

The last two articles discuss open design issues. First, D. Fallows et al. [A5] present the past and present developments of “Exciterless Wound-Field Medium-Power Synchronous Machines” with a special

emphasis on the new wireless power transfer excitation systems. Finally, in “Hairpin Windings: An Opportunity for Next-Generation E-Motors in Transportation,” S. Nuzzo et al. [A6] look into hairpin windings and outline a number of future actions to address challenges such as power density, reliability, and automation requirements in view of a massive penetration of hairpin windings in transportation.

Also, don’t miss the rich editorial content of this issue, like the very interesting “History” column, “Secondary Batteries for Mobile Applications:

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From Lead to Lithium,” by Massimo Guarnieri [A7]. In the “Society News” column [A8], you’ll also find out more about the recipients of the 2022 IES awards; congrats to all of them! Also, the “News in Industry Activities” column by Victor Huang [A9] is at full capacity with detailed reports of two industry forums and an Industry Day.

I am also very happy to introduce two new associate editors: Dr. Gerhard P. Hancke from the City University of Hong Kong, China, and Dr. Samir Kouro from Federico Santa Maria Technical University, Valparaiso, Chile. Both were recipients of the IEEE Industrial Electronics Magazine Best Paper Award, in 2018 and 2021, respectively.

Finally, I would like to express my deepest gratitude to Prof. Jose Fernando Da Silva, who has served as the “Book Review” column editor for

IEM since 2010 and who is retiring in January 2023. His book reviews were very appreciated for their detailed analysis and reliable judgment. So thank you, Fernando, for all that you have done for *IEM*, and enjoy your new life! Fernando will be replaced by Prof. Giovanni Spagnuolo from Salerno University, Italy. Giovanni is a renowned scientist in the field of renewable energy systems, an IEEE Fellow, and an active IES volunteer.

On behalf of all the members of the *IEM* editorial team, I wish you a happy and healthy 2023!

Appendix: Related Articles

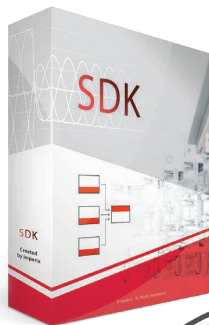
- [A1] J. K. Noland et al., “Next-generation cryo-electric hydrogen-powered aviation: A disruptive superconducting propulsion system cooled by on-board cryogenic fuels,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 6–15, Jun. 2, 2022, doi: 10.1109/MIE.2022.3174332.
- [A2] J. Choi et al., “The history and future of the WalkON Suit: A powered exoskeleton for people with

- disabilities,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 16–28, 2022, doi: 10.1109/MIE.2021.3113267.
- [A3] M. J. Duran et al., “The evolution of model predictive control in multiphase electric drives: A growing field of research,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 29–39, May 17, 2022, doi: 10.1109/MIE.2022.3169291.
- [A4] S. B. Lee et al., “The commercialization of medium-voltage induction motor rotor diagnostics equipment,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 40–43, 2022, doi: 10.1109/MIE.2022.3144912.
- [A5] D. Fallows et al., “Exciterless wound-field medium-power synchronous machines: Their history and future,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 44–51, 2022, doi: 10.1109/MIE.2021.3093024.
- [A6] S. Nuzzo et al., “Hairpin windings: An opportunity next-generation E-motors transportation,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 52–59, 2022, doi: 10.1109/MIE.2021.3106571.
- [A7] M. Guarnieri, “Secondary batteries for mobile applications: From lead to lithium,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 60–68, 2022, doi: 10.1109/MIE.2022.3212242.
- [A8] Ó. Lucia, “Society news,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 69–76, 2022, doi: 10.1109/MIE.2022.3212246.
- [A9] V. Huang, “News in industry activities,” *IEEE Ind. Electron. Mag.*, vol. 16, no. 4, pp. 77–85, 2022, doi: 10.1109/MIE.2022.3212609.



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