BILINGUAL PUBLISHING GROUP

Semiconductor Science and Information Devices

https://journals.bilpubgroup.com/index.php/ssid

EDITORIAL

Minus Infinity Plus Infinity

Kasturi Vasudevan

Department of EE IIT, Kanpur, 208016, India

Mankind has always been fascinated by nature and has striven to understand its functioning. What lies beyond the stars, what hides inside atoms, how to reach the stars, how to tap the vast energy inside the atoms, what is the correlation between space and time and how to exploit it—these are only a sample of the infinite questions to which we seek answers. In this editorial we explore some of the pressing issues that we are currently trying to address.

First and foremost is renewable energy. With the rapid depletion of fossil fuels, there is an urgent need to look for alternatives in the form of solar, wind, tidal waves, hydro, geothermal and biomass. The current efficiency of solar panels is 23%, wind turbines 40%, tidal turbines 80%, hydro 90%, geothermal 17% and biomass 45%. Space-based solar power is an active area of investigation. The energy generated may have to be stored in batteries with fast charging and high power (or energy) to weight ratio. New generation lithium-ion, lithium-sulphur and solid state are batteries of the future with applications in transportation e.g., electric vehicles (EVs). When EVs are around, can electric airborne vehicles (EAVs) be far behind? Small passenger EAVs are currently in the prototype stage. However, for large passenger EAV, the main bottleneck is batteries. Solar-powered aircraft also appear to be a feasible option.

Close on the heels of EVs and EAVs are autonomous vehicles (AVs), which brings us to the realm of artificial intelligence (AI) and machine learning (ML). AI and ML are based on neural networks that use mixed-signal processing, that is, analog and digital. Analog computers are faster and consume less power compared to their digital counterparts. However, analog computers are less reliable and less accurate compared to digital computers. For large neural networks, a mix of both analog and digital processors is required. AVs find application in space exploration and mining. An

*CORRESPONDING AUTHOR:
Kasturi Vasudevan, Department of EE IIT, Kanpur, 208016, India; Email: vasu@iitk.ac.in

ARTICLE INFO
Received:10 April 2023 | Accepted: 19 April 2023 | Published Online: 25 April 2023
DOI: https://doi.org/10.30564/ssid.v5i1.5644

CITATION
Vasudevan, K., 2023. Minus Infinity Plus Infinity. Semiconductor Science and Information Devices. 5(1): 1-2. DOI: https://doi.org/10.30564/ssid.v5i1.5644

aircraft is also an AV, since it uses fly-by-wire and instrument landing systems (ILS). Talking of space brings us to the pertinent question—is mankind going to be a multi-planetary species? If yes, what is going to be our mode of transport for interplanetary or intergalactic travel? Is it a warp drive, ion thruster or antimatter rocket? How do we adapt to different types of planetary environments? Will space mining lead to the discovery of new elements? Will the Periodic Table be modified?

Turning our attention to the telecommunications sector, we find that there is a demand for higher data rates per user for applications like AVs, remote teaching, remote surgeries, video conferencing and so on. The 6th generation (6G) and beyond wireless standards could improve the data rates using spatial multiplexing by having multiple antennas at the mobile handset as well as the base station. Having multiple antennas in the mobile handset is feasible in mm-wave frequencies (30-300 GHz). The propagation characteristics of mm-wave could be improved using reconfigurable intelligent surfaces (RIS). Present-day telecommunications take place at the speed of light. Perhaps it may be possible to use principles of quantum entanglement to achieve instantaneous telecommunication over any distance. Quantum computers can solve certain class of problems that are infeasible with conventional digital computers. Quantum cryptography could be used to improve telecommunication security. Photonic qubits or quantum chips could be used to operate a quantum computer at room temperature instead of near absolute zero. Whatever the application, be it solar panels, batteries, mixed-signal processors, rocket engines, RIS or quantum chips—materials science in association with signal processing will play a major role in the advancement of technology. It is also apparent that research is usually multidisciplinary. A product is a culmination of many ideas.

That said, before mankind ventures on interplanetary or intergalactic sojourns, it is necessary to conserve the flora and fauna at home. In particular, the air and water need to be cleaned up. By cleaning up, we mean, not polluting them in the first place. Are we going to explore $[-\infty, +\infty]$ in time or $10^{-\infty}, 10^{+\infty}$ in space or both are anyone's guess. There are exciting times ahead—if there is a wish to know and do more.