

ARAI Journal of Mobility Technology

A Quarterly Peer-Reviewed Journal

<https://araijournal.com/index.php/arai>

Volume 3, Issue 2, April-June, 2023

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Publication from



The Automotive Research Association of India

An ISO 9001, ISO 14001, ISO 27001, ISO 45001:2018 and NABL Accredited R&D Institute



Editorial

Online: ISSN: 2583-3707

ARAI Journal of Mobility Technology

<https://araijournal.com/index.php/arai>

Volume 3 • Issue 2 • April – June, 2023

DOI:10.37285/ajmt.3.2.0



Dr. Anindya Deb

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Despite the fact that the embodiment of a motor car, to be precise a “horseless carriage” at its time, as well its potent propulsion system, viz. a two-stroke IC (Internal Combustion) engine, were pioneered by Carl Benz in Germany way back in 1886, and the well-over-a-century that has passed by since then, making the HC (hydro-carbon) fuel-propelled IC engine one of the most matured, reliable and refined technologies ever developed, the global automotive industry is finding itself on cross-roads today driven by the possibility of large-scale transition to electric motor and battery-driven vehicles.

Although electric motors have been the proven workhorses for innumerable industrial and consumer applications, they have not been adequately customized for personal modes of transportation. Unlike in the case of IC engines which are mainly limited to two types viz. spark and compression ignition engines, electric motors come in many varieties such as DC (Direct Current), 3-phase induction, BLDC (Brushless DC), switched reluctance, etc. Some of the principal motor types mentioned can have unique variants as well, and the most efficient ones can also be distinguished by the presence of permanent magnets which may require esoteric and costly rare-earth elements available in only a handful of regions in the world. It is noted here that while electric motors offer greater options as compared to IC engines, the sheer variety also causes confusion and dilemma in design. Similarly, there are challenges associated with the design and manufacturing of electronic power control units. There is a question mark on the sustainability of Li (lithium) ion-based batteries if they become rampant, and the grid power required for charging batteries. Creating adequate charging infrastructure is another formidable task, to say the least.

In order to overcome the range limitations of zero-emission battery/plug-in electric vehicles, other alternatives have been proposed such as hybrid electric vehicles and hydrogen-powered fuel cell vehicles. Professionals engaged in vehicle design are perhaps all too familiar with the relative complexities of hybrid electric vehicles in terms of transmission, electronic controls, packaging, and cost. Polymer Electrolyte Membrane (PEM) fuel cells apparently can overcome the range limitations of battery electric vehicles and the hindrance of substantive battery charging time, but are plagued with high cost, safety hazard due to on-board storage of highly compressed hydrogen, apprehensions on durability and robustness, etc.

While the automotive engineering community is preoccupied with overcoming the energy and powertrain-related challenges posed by EVs, it is often forgotten that the fundamentals of vehicle design driven by attributes such as Styling, Aerodynamics, Vehicle Dynamics, Ergonomics, NVH (Noise, Vibration and Harshness), Durability, Crash Safety, etc. do not change. In particular, collision safety standards such as US-NCAP and EuroNCAP remain the same for an EV. In order to enhance the energy

efficiency of battery electric vehicles, these need to be as lightweight as possible which introduces difficulties in leveraging the advantage of lower density of lightweight materials such as aluminium, composites, etc. by circumventing their shortcomings in mechanical performance, manufacturability, and cost.

It is clear that the automotive horizon today is ripe with exciting opportunities of both technical and entrepreneurial nature. The *ARAI Journal of Mobility Technology* has stepped in at the right time to be an effective forum for publishing high quality research work in automotive design, engineering and manufacturing including on related topics in areas such as computer-aided engineering, artificial intelligence and machine learning, additive manufacturing, and active safety with autonomous interventions, to name a few. With the valuable peer-reviewed contributions of the thriving Indian academic and industrial research community, and global researchers in the all-encompassing field of mobility engineering, the author is confident that the *ARAI Journal of Mobility Technology* will soon establish itself as a global mouthpiece of stellar repute.

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ARAI Journal of Mobility Technology

ARAI J. Mobi. Tech (AJMT); *Online Access & Print Journal*

<https://araijournal.com/index.php/arai>

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BASIC INFORMATION

Title	ARAI Journal of Mobility Technology
Acronym	AJMT
Language	English
Subject	Engineering (Automotive)
Start Year	2021 (October-December)
Publishing Frequency	Quarterly (Jan, Apr, July, Oct)
Owned by	The Automotive Research Association of India, Pune
Editor Name	Dr. S. S. Thipse
Editorial Office Address	Survey No. 102, Vetel Hill, off Paud Road, Kothrud, Maharashtra - Pune - 411 038, India. P. B. No. 832, Pune - 411 004
Phone	(020)-3023-1434, Mob: 9822867405
E-mail	thipse.edl@araiindia.com
Website	https://araijournal.com/index.php/arai
Publication Nature	Both (Print & Online)
ISSN (Online)	2583-3707

PUBLISHER INFORMATION

Name of Publisher	Mr. Nitin B. Dhande
Country of Origin	India
Registered Address	The Automotive Research Association of India (ARAI), Survey No. 102, Vetel Hill, off Paud Road, Kothrud, Maharashtra - Pune - 411 038, India.
Email	dhande.dts@araiindia.com
State	Maharashtra
Contact No. / Phone	(020)-3023-1130 Mob: 9975581046
Website	https://araijournal.com/index.php/arai
Publishing Office Address	P. B. No. 832, Pune - 411 004

IMPRINT LINE

Printed and Published by Mr Nitin B. Dhande, Sr. Deputy Director, ARAI, Pune, on behalf of The Automotive Research Association of India, printed at Aditya Offset Process (I) Pvt. Ltd. H.No:- # 3-1/7, Survey No.56/1, Jalapally Village, Saroornagar Mandal, Ranga Reddy Dist. Hyderabad 500005 and published from Automotive Research Association of India, Survey No. 102, Vetel Hill, Off Paud Road, Kothrud, Pune - 411 038, Maharashtra, India. Editor Dr S.S. Thipse, Sr. Deputy Director, ARAI, Pune.

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