Rare-Earth Supply Concerns Renew Interest in Active-Rotor Electric Machine Technology, Says Best Electric Machine

Growing concern over China-dominated rare-earth supply chains is renewing interest in active-rotor electric machine technology.

BOSTON, MA, MA, UNITED STATES, June 17, 2026 /EINPresswire.com/ -- Best Electric Machine (BEM) announced today that historical research into doubly-fed electric machines may warrant renewed attention as the automotive, aerospace, industrial, and defense sectors seek alternatives to rare-earth permanent-magnet (RE-PM) motor systems while maintaining or potentially improving performance.

Best Electric Machine Logo – Developer of SYNCHRO-SYM™ E-Motor

According to BEM, laboratory research conducted over several decades demonstrated that electric machines employing both an active stator and active rotor architecture could achieve substantially higher air-gap utilization than conventional electric machines employing an active stator and passive rotor architecture. However, practical implementation was limited by the real-time control technology available at the time.

By actively contributing to electromagnetic energy conversion from both stator and rotor, such symmetric architectures have historically demonstrated greater utilization of the machine's electromagnetic structure, providing the potential for substantial performance improvement.

"The historical challenge was not necessarily electromagnetic performance," said Frederick Klatt, Chief Technology Officer of Best Electric Machine. "The challenge was achieving automatic real-time control of the interaction between active stator and active rotor systems under random line

disturbances, load changes, and shaft perturbations using the electronics available decades ago."

Given the control limitations of the era, the most practical path to commercialization was electric machine systems based on the electromagnetic asymmetry of induction, reluctance, permanent-magnet, and wound-field passive rotors. As rare-earth permanent-magnet (RE-PM) technology matured, industry investment increasingly shifted toward asymmetric passive-rotor RE-PM-based motor systems. Today, approximately 85% of electric vehicles utilize RE-PM motor systems, while concerns regarding rare-earth supply chains have intensified.

Growing geopolitical concerns surrounding the concentration of rare-earth mining, processing, and magnet production have elevated the strategic importance of alternative motor technologies for transportation, industrial, aerospace, and national-security applications, most of which remain based on passive-rotor architectures such as induction, reluctance, permanent-magnet, and wound-field machine systems, each involving tradeoffs among performance, cost, complexity, and material requirements.

BEM believes advances in high-frequency electromagnetics, digital signal processors, power semiconductors, sensors, embedded computing, adaptive control algorithms, and artificial intelligence may fundamentally alter the practicality of active-rotor motor architectures.

"As governments and manufacturers seek to reduce dependence on concentrated rare-earth supply chains, active-rotor technologies previously considered impractical may deserve a second look," Klatt said.

"Many technologies were conceived long before enabling electronics made them commercially practical," Klatt added. "Electric vehicles, fly-by-wire aircraft, active suspension systems, and neural networks all benefited from advances in computing and control technology. We believe active-rotor electric machine systems deserve a fresh examination under today's technological conditions."

Unlike many emerging propulsion concepts, active-rotor machine architectures are not new. The underlying symmetric electromagnetic principles of these architectures have been studied for decades; the primary historical obstacle was practical real-time control rather than electromagnetic theory. BEM's position is that advances in modern high-frequency electromagnetics, control electronics, sensors, power semiconductors, and computational capability may now enable practical implementation of advantages that earlier researchers could not fully commercialize.

BEM’s patented SYNCHRO-SYM™ electric machine architecture with Brushless and Sensorless Real-Time Emulation Control (BRTEC™) is based on a symmetric active-stator/active-rotor topology intended to eliminate rare-earth permanent magnets while increasing electromagnetic utilization and reducing dependence on strategically sensitive materials.

BEM has compiled a bibliography spanning more than six decades of laboratory and academic research related to doubly-fed, active-rotor machine architectures and encourages researchers, industry leaders, and government agencies to reexamine these technologies in light of modern control capabilities and growing concerns regarding rare-earth supply security.

Sixty years of active-rotor research supporting SYNCHRO-SYM [http://bestelectricmachine.com/sixty-years-of-selected-synchro-sym-study/] contains an abridged bibliography of historical research indicating that the principal challenge facing active-rotor architectures was the limitations of control technology rather than electromagnetic feasibility.

For additional information, visit www.BestElectricMachine.com.

About Best Electric Machine (BEM)
Best Electric Machine is developing the SYNCHRO-SYM™ electric machine system and BRTEC™ direct AC-to-AC controller technology. BEM's mission is to provide high-performance axial-flux, symmetric electric propulsion systems while eliminating reliance on rare-earth permanent magnets.

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