# TUTORIAL 4

## *"Regenerative Motor Drive Systems for Industrial Applications"*

SPEAKER

**Ahmed Sayed-Ahmed**

*Rockwell Automation*

SPEAKER

**Yogesh Patel**

*Rockwell Automation*

Over the last few decades, and especially with recent green energy initiatives, regenerative motor-drive systems have become more widely used in numerous industrial applications. The utilization of Active Front End (AFE) power converters coupled with inverters is one of the most accepted power electronic configurations for these drives. Although much attention is given to the design and control of AFE power converters in grid-tie applications, the same cannot be said for regenerative motor-drive applications.

The main advantages of adopting AFE-based power converters in regenerative motor-drive systems include the capability to supply energy back to the grid instead of dissipating excess energy in a resistor. This often requires additional cooling and space. They also offer unity power factor and low total harmonic distortion, which often results in reduced sizing of the main feeder, decreased system losses, and improved system efficiency. AFE-based power converters can also be properly controlled to inject reactive power compensation to the line, thereby enhancing the power factor of the entire utility.

This tutorial focuses on the design and analysis of industrial AFE-based power converters in regenerative motor-drive systems. It is divided into four main parts: the first part discusses type of adjustable drives, drives applications. The second part discusses power electronics and filter design, highlighting the main trade-offs in the design process along with thermal considerations; the third part centers on different modes of operation and control design; and the fourth part discusses technical application challenges associated with the deployment and operation of AFE-based power converters.

IEMDC 2025

International Electric Machines & Drives Conference

Houston, TX  May 18 - 21, 2025

**Registration open at:**

**https://www.iemdc.org**

# BIOS

*"Regenerative Motor Drive Systems for Industrial Applications"*

**SPEAKER**

**Ahmed Sayed-Ahmed**

*Rockwell Automation*

**SPEAKER**

**Yogesh Patel**

*Rockwell Automation*

**Ahmed Sayed-Ahmed** (S'05–M'09) received his B.Sc. and M.Sc. degrees in Electrical Engineering from Cairo University, Egypt, in 1998 and 2003, respectively. He earned his Ph.D. in Electrical Engineering from Marquette University, WI, USA, in 2009. He holds more than 30 US patents and has over 26 peer-reviewed journal and conference publications, including the IEEE Transactions on Energy Conversion prize paper award for 2012. His expertise is recognized by reputed institutions such as Marquette University and the Milwaukee School of Engineering, where he currently teaches several graduate and undergraduate classes in control design, power electronics, and electrical machines. Dr. Sayed-Ahmed is currently a Senior Principal Engineer and serves as a Product Owner at Rockwell Automation in the R&D Department. He has over 24 years of industrial and research experience, including control and design of motor-drive systems, embedded real-time control systems applied to power electronic applications, power system analysis, and the oil and gas industry. His current role involves leading and mentoring a highly energetic and dynamic technical team of control engineers to design and implement complex control algorithms for Rockwell's high-power regenerative motor-drive systems and compact drives.

**Yogesh Patel** (M'010) received his BS degree in electrical engineering from Maharaja Sayajirao University of Baroda. India and MS degree in Electrical Engineering from Illinois Institute of Technology, Chicago, 2003 respectively. He earned his Ph.D. in Electrical Engineering from University of Wisconsin Milwaukee, WI, USA, in 2012. He holds more than 20 US patents and has over 6 peer-reviewed journal and conference publications. Yogesh Patel is currently a Principal Engineer, and a Global Functional Lead at Rockwell Automation in the R&D Department. He has over 23 years of industrial and research experience, including adjustable speed drive design, power supply design, system configurations, and new product development.

**IEMDC 2025**
International Electric Machines & Drives Conference
Houston, TX May 18 - 21, 2025

**Registration still open at:**

https://www.iemdc.org