

# Energy efficiency improvement for electrical machines: a challenge

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## Abstract

The principle of electrical machines has been known for at least 500 years with the first electrostatic machines invented around 1600. The first electromagnetic machines have been imagined later in the 17<sup>th</sup> century after the discovery of the electromagnetism principle. However, it has been necessary to wait up to the end of the 19<sup>th</sup> century to have rotating electrical machines structures close to what they are nowadays. Basically, the presentation starts from the classical definition of units for power and energy. Then, the definition of energy efficiency is discussed and developed before giving the current status of efficiency in modern electrical machines. The last part of the presentation is dedicated to trends for improving the efficiency by both design and manufacturing processes. A short highlight of fault tolerance, even if not fully related to energy efficiency, is also presented since it is an actual need for systems using electrical machines for both motoring and generating.

## Bio



**G rard-Andr  Capolino** (A'77–M'82–SM'89–F'02) was born in Marseille, France. He received the B.Sc. degree in electrical engineering from the Ecole Centrale de Marseille (ECM), Marseille in 1974, the M.Sc. degree from the Ecole Sup rieure d'Electricit  (Supelec), Paris, France, in 1975, the Ph.D. degree from the Aix-Marseille University (AUM), Marseille, in 1978, and the D.Sc. degree from the Institut Polytechnique de Grenoble (Grenoble INP), Grenoble, France, in 1987.

He had several faculty positions in Yaound , Cameroun, Le Creusot, France and Marseille, France. In 1994, he joined the University of Picardie "Jules Verne," Amiens, France, as a Full Professor and was appointed Chair Professor in 2013. Since 1975, he has published more than 450 papers in scientific journals and conference Proceedings. He has been the principal investigator for more than 50 research contracts.

Dr. Capolino is an Associate Editor of the IEEE TRANSACTIONS ON POWER ELECTRONICS, of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS and of the IEEE ACCESS. He is also the acting Chair for the Steering Committee of the International Conference on Electrical Machines (ICEM).

During 2012–2013, he was the President of the IEEE Industrial Electronics Society (IES). He has been also the IEEE France Section Chair (2005–2007).