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Currents' Physical Components (CPC): a new framework for studies on Power Quality and its improvement

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Abstract

Studies on Power Quality and its improvement are shadowed by a century-long controversy on power properties of electrical systems, definitions of powers, and the possibility and methods of compensation. There are several schools, established by Budeanu, Fryze, Kusters, Shepherd, Depenbrock, Akagi, Czarnecki, or Tenti, that handle these issues in a mutually different way, some of them are even supported by international or national standards.

The concept of Currents' Physical Components (CPC) identifies physical phenomena associated with energy flow in electrical systems and clarifies century-lasting controversies as to power properties and powers in such systems and the methods of compensation. It was developed for cognitive reasons and to provide physical fundamentals for improving the effectiveness of electric energy transfer. It has occurred to be a powerful tool for that.

Although the CPC was not developed for that purpose, it might appear to be a very beneficial tool for studies on Power Quality and the methods of its improvement. The CPC identifies physical phenomena responsible for the degradation of the Loading Quality (LQ), Supply Quality (SQ), and in general, Power Quality (PQ), as well as it might specify the possibilities and tools for their improvement. If the CPC has occurred to be so efficient in studies on the power factor and its improvement, why this could not be similar in studies on the Loading and Supply Qualities? Problems related to Power Quality degradation are strongly associated with power factor degradation. All of these should be investigated because the CPC is a relatively new concept, still not well disseminated in the power engineering community. It seems that the CPC opened new vistas for studies on Power Quality and its improvement.

Short biography of Prof. Dr. Leszek S. Czarnecki



Leszek S. Czarnecki, IEEE Life Fellow, Distinguished Professor at Louisiana State University, Titled Professor of Technological Sciences, granted by the President of Poland. He received an M.Sc., Ph.D., and D.Sc. degrees in electrical engineering from the Silesian University of Technology, Poland. For two years he was with the Power Engineering Section, of the National Research Council (NRC) of Canada, as a Research Officer, and for two years with the Electrical Engineering Dept. at Zielona Gora University, Poland. In 1989 Dr. Czarnecki joined the Electrical and Computer Engineering Department of Louisiana State University (LSU), Baton Rouge.

For developing a power theory of three-phase systems with nonsinusoidal and asymmetrical voltages and currents and for methods of compensation of such systems he was elected to the grade of IEEE Fellow in 1996.

Development of the Currents' Physical Components (CPC) – based power theory which explains all physical phenomena that specify power properties of electrical systems and creates fundamentals for compensation in circuits of any complexity, was the major professional Dr. Czarnecki's contribution to electrical engineering, for which he was nominated to the IEEE Proteus Charles Steinmetz Award. In 2019 Stanford University, USA, recognized Dr. Leszek S. Czarnecki as the World's 2% best faculty. A book based on the CPC, titled: Powers in Compensation in Circuits with Nonsinusoidal Currents, is currently printed by Oxford University Press.

Dr. Leszek S. Czarnecki was decorated by the President of Poland, for his public activity in the United States of America, aimed at the acceptance of Poland in NATO, with the Knight Cross of the Medal of Merit of the Republic of Poland.

Dr. Czarnecki was involved in mountaineering and underwater photography. He climbed, without oxygen support, Lhotse (No. 4 in the World) in the Himalayas (8350m); he completed the first climbing of the main ridge of the Rwenzori Mountains in Central Africa (19 summits of an average high of 5000m), climbed Mt. Kilimanjaro, and Mt. Kenya; traversed on ski (500km) Spitsbergen in the deep Arctic; climbed in Alpes and Andes; climbed solo Denali in Alaska, the highest mountain in North America, and traveled to Antarctica.