

Introduction In ancient times, thunder, lightning and electric fish [1] were the natural phenomena related to electricity. For instance, high-accuracy and high-frequency control methods based on single-chip solutions like Digital Signal Processors, Field Programmable Gate Arrays or Complex Programmable Logic Devices are applied to meet desired requirements and to gain better control of loads; more accurate mathematical methods to model power converters enable gaining better output features, reducing energy losses and increasing efficiency; and improved control algorithms are utilised to improve efficiency and robustness, to reduce complexity and to achieve better output features. The first power electronics device was the mercury arc rectifier developed in 1900, followed by other power devices, like metal-tank rectifier, grid-controlled vacuum tube rectifier, ignitron, phanotron, thyatron and magnetic amplifier, developed and deployed gradually for power-control applications until the 1950s. Since then, a series of great discoveries on the principles of electricity and magnetism has been achieved by Volta, Coulomb, Gauss, Henry, Faraday and others, leading to many inventions such as batteries (1800), generators (1831), electric motors (1831), telegraphs (1837) and telephones (1876), to name just a few. Included here are improved bipolar transistors (with fine structures, and also shorter switching times), metal-oxide-semiconductor field-effect transistors (MOSFETs), gate turn-off thyristors (GTOs) and insulated-gate bipolar transistors (IGBTs). Thereafter, G. Westinghouse applied transformers in AC distribution systems to transmit electricity efficiently over long distances, which has promoted the development of electrical engineering [5]. Electric power deals with static and rotating power equipment for generation, transmission and distribution of electric power; while electronics is concerned with solid-state semiconductor power devices and circuits together with control systems for power conversion specified to meet the desired control objectives. It is now well known that electricity must be transmitted at high voltages and in the form of alternating current (AC), because DC voltage could not be increased or decreased by DC systems at that time [8]. In practical applications, electric energy was expected to be converted from one form to another, for instance, between AC and DC, or just to different voltages or frequencies, or some combinations of those -- demands that cannot be fully met by transformers. Moreover, energy loss in transformers, magnetic radiations, huge volume and high cost of [copper limited their wider use [9