Chapter 11
Implementation of Improved Control Strategy of DC–AC Converter using Delta–Sigma Modulator

Mohamayee Mohapatra
Indira Gandhi Institute of Technology, India

Chitti Babu Baladhandautham
Technical University of Ostrava, Czech Republic

ABSTRACT
This Chapter presents a comparative study between two current control techniques, namely, conventional Delta Modulator and novel Delta-Sigma Modulator. The use of Delta modulator in variable speed drives poses a problem of noise while converting analog signal in to digital form; to optimize Pulse Width Modulated (PWM) inverter waveforms on-line without any optimization process. But in the Delta-Sigma Modulator the noise varies. It can be successfully applied to over-sampling digital-to-analog and analog-to-digital data converters, switch mode power supplies and inverters It is easy to implement, smooth inverter operation and provides low harmonics at the inverter output. The comparative study between the above said current controllers has been verified by the MATLAB computer simulation in terms of the high frequency power spectra, average switching frequency, rms current error and total harmonic distortion of load current waveforms. The obtained theoretical results are validated with experimental platform based on TMS320F2812 digital signal processor for effectiveness of the study.

INTRODUCTION
The electrical power sector is continuously facing rapid change due to industrialization, rising cost of energy, mass electrification and climate change etc. Fan et.al (2013) carried out a survey on smart grid based on some of the challenges and opportunities of communications between various grid elements in generation, transmission, distribution and loads in the areas of smart grid and smart metering. Fang

et.al (2011) showed in their work that three major systems namely the smart infrastructure system, the smart management system and the smart protection system combinely formed the smart Grid system. The Smart Grid which is the next generation power grid, uses two-way flows of electricity and information to create a widely distributed automated energy delivery network. Lund (2012) discussed the challenges put forth due to the intermittent nature of renewable energy and to integrate this fluctuating power from renewable energy sources in the electricity grid by the use of smart grids. It cannot be looked upon as an isolated issue but seen as one out of various means and challenges of approaching sustainable energy systems in general. Therefore, electricity smart grids must be coordinated with the utilization of renewable energy being converted into other forms of carriers than electricity including heat and biofuels as well as energy conservation and efficiency improvements. The integration of renewable energy systems (RESs) in smart grids (SGs) is a challenging task, mainly due to the unpredictable nature of the sources, typically wind or sun. Another issue concerning the way to support the consumers’ participation in the electricity market aiming at minimizing the costs of the global energy consumption. To overcome this an energy management system (EMS) is proposed by Cecati (2011) aiming at optimizing the Smart Grid operation. By integrating demand side management (DSM) and active management schemes (AMS), a better exploitation of renewable energy sources and a reduction of the customers’ energy consumption costs with both economic and environmental benefits achieved by this technique. Kanchev et.al (2011) implemented energy management tools for next-generation Photovoltaic (PV) system with embedded storage units and a gas micro turbine for business customers in a micro grid power system. Brown et.al (2008) discussed the impact of smart grid on distribution generation. Wind power is still the most promising renewable energy in the year of 2013. The wind turbine system (WTS) started with a few tens of kilowatt power in the 1980s. Now, multi megawatt wind turbines are widely installed even up to 6–8 MW. Blaabjerg et.al(2013) described how by proper controls and grid regulations, it is possible for the wind farms to act like conventional power plants and actively contribute to the frequency and voltage control in the grid system which is more suitable to be integrated into the power grid. Strunz et.al (2014) presented a design of an aggregated model of renewable wind and solar power generation forecast to support the quantification of the operational reserve for day-ahead and real-time scheduling. Anees (2012) discussed challenges, issues and possible solutions related to grid integration of RES. To minimize the fluctuations and intermittent problems, power electronics devices are the viable options. Further, energy storage and use of dump load and MPPT could be used for reducing the power fluctuations in PV systems. Wandhare et.al (2014) proposed an integrated scheme of solar PV with a large capacity doubly excited induction generator based wind energy system which uses both the grid and rotor side power converters of DFIG to inject PV power into the grid. Purchalaet.al (2006) described in detail the DPGSs structure and grid integration issues. Blaabjerg et.al (2006) showed in their work the hardware structure of DPGS, control structures for the grid connected inverter, control strategies under fault condition and influence of grid synchronization algorithm on the control of grid connected inverter. Blaabjerg et.al(2004) showed in their work how Power electronic converters are being increasingly utilized in distributed generation (DG) applications are efficiently processing electric power is used in the integration of grid to the primary energy source, be it a PV array, a small wind turbine, a micro turbine, a fuel cell etc. Iov et.al (2008) discussed in his work that the most emerging renewable energy sources like wind energy now adays acting as an important power source due to the development of the power electronics converters. So by means of this power electronic converters wind energy is changing from being a minor energy source to be as an important power source in the energy system. Evju (2007) presented power electronics converter system for photovoltaic energy application.Timbus et.al (2006) divided
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