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CONCORSO PUBBLICO, PER TITOLI E COLLOQUIO, PER IL CONFERIMENTO DI N. 1 ASSEGNO PER LO SVOLGIMENTO DI ATTIVITÀ DI RICERCA SULLA TEMATICA “Progetto ed implementazione sperimentale di strategie di controllo innovative per azionamenti elettrici basate su FPGA” – S.S.D. ING-IND/32 – CODICE CONCORSO PICA DIII2021-B06 – Responsabile Prof. Pericle Zanchetta - Bando indetto con Decreto Direttoriale n. 123/2021 in data 28/09/2021

TRACCE PROVE ORALI

Il colloquio orale è stato svolto per via telematica. Gli argomenti trattati sono i seguenti:

- Azionamenti con motore sincrono a riluttanza
- Model predictive control
- Implementazione di algoritmi per il controllo degli azionamenti su piattaforme DSP/FPGA

- Prova di conoscenza della lingua inglese mediante lettura e traduzione di un brano di un libro come da file allegato

CHAPTER 9

RESONANT CONVERTERS: ZERO-VOLTAGE AND/OR ZERO-CURRENT SWITCHINGS

9-1 INTRODUCTION

In all the pulse-width-modulated dc-to-dc and dc-to-ac converter topologies discussed in Chapters 7 and 8, the controllable switches are operated in a switch mode where they are required to turn on and turn off the entire load current during each switching. In this switch-mode operation, as explained further in Section 9-1-1, the switches are subjected to high switching stresses and high switching power loss that increases linearly with the switching frequency of the PWM. Another significant drawback of the switch-mode operation is the EMI produced due to large di/dt and dv/dt caused by a switch-mode operation.

These shortcomings of switch-mode converters are exacerbated if the switching frequency is increased in order to reduce the converter size and weight and hence to increase the power density. Therefore, to realize high switching frequencies in converters, the aforementioned shortcomings are minimized if each switch in a converter changes its status (from on to off or vice versa) when the voltage across it and/or the current through it is zero at the switching instant. The converter topologies and the switching strategies, which result in zero-voltage and/or zero-current switchings, are discussed in this chapter. Since most of these topologies (but not all) require some form of LC resonance, these are broadly classified as “resonant converters.”

9-1-1 SWITCH-MODE INDUCTIVE CURRENT SWITCHING

This topic was briefly reviewed in Chapter 2. To illustrate further the problems associated with switch-mode operation, consider one of the legs of a full-bridge dc–dc converter or a dc-to-ac inverter (single phase or three phase), as shown in Fig. 9-1. The output current can be in either direction and can be assumed to have a constant magnitude I_o due to the load inductance, during the very brief switching interval. The linearized voltage and current waveforms, for example, for the lower switch T_- are shown in Fig. 9-2a.