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The total length of this report, including questions, answers, tables and figures, shall not exceed 10 pages. It is mandatory for this report to be compiled in TeX, with the provided template.

1 THREE-PHASE INVERTER MODELLING

1. Show your switched model implementation in PLECS.

...to be filled in...

2. Show a capture of the "Converter Voltages & References" scope. Explain what you see and describe what is happening at relevant time instances. Show a capture of the "Switched model Voltages and Currents" scope. Explain the behavior of the grid currents for the different converter voltages applied during the sequence.

...to be filled in...

3. Model the system in the $\alpha\beta$ reference frame. Show your model implementations (PLECS block diagram). Provide a capture of the inverter and grid voltage and grid currents in the $\alpha\beta$ reference frame.

...to be filled in...

4. Model the system in the dq reference frame. Show your model implementations (PLECS block diagram). Provide a capture of the inverter and grid voltages and grid currents in the dq reference frame.

...to be filled in...

5. Transform currents obtained by these models into the abc reference frame. Show your model in abc reference frame and comment on the results. Compare the results with those obtained from the switched model (show and discuss the capture of the "Model Comparison" scope).

...to be filled in...

2 THREE-PHASE INVERTER CBPWM

1. Carrier based PWM implementation:

(a) Give DC-link voltage calculation.

...to be filled in...

(b) Give the maximum rms phase voltage output that can be synthesized by the converter without going into over modulation and the modulation index for reference output voltage.

...to be filled in...

(c) Show your CB-PWM implementation with the reference normalization and explain it. Show your results.

...to be filled in...

(d) Discuss the influence of the modulation index change. Provide relevant scope captures.

...to be filled in...

(e) Explain what modification leads to operation similar to that of six-step modulation. Provide relevant scope captures.

...to be filled in...

2. Zero-sequence injection:

(a) Give the value of the third harmonic to be added and explain.

...to be filled in...

(b) Give the maximum modulation index and explain your reasoning.

...to be filled in...

(c) Show your implementation of the third-harmonic injection in PLECS, your modulation signals and your results.

...to be filled in...

(d) Show your implementation of the min-max injection in PLECS, your modulation signals and your results.

...to be filled in...

(e) Show your comparison between CB-PWM (from Task 1) and one of zero sequence injection method. Analyze the frequency spectrum of converter variables for a modulation index that you consider relevant, and explain why you chose it.

...to be filled in...

3 THREE-PHASE INVERTER SVPWM

1. SV-PWM implementation:

(a) Explain how the magnitude of the reference space vector is obtained in $\alpha\beta$ frame.

...to be filled in...

(b) Explain how the angle of the reference space vector is obtained in $\alpha\beta$ frame.

...to be filled in...

(c) Show your sector detection implementation in PLECS.

...to be filled in...

(d) Provide the duty cycle calculation equations and show and/or explain the PLECS implementation.

...to be filled in...

(e) Assemble the switching pattern for odd and even sectors

...to be filled in...

(f) Send the PWM signals out (sw)

...to be filled in...

2. Converter operation with SV-PWM:

(a) What modulation index corresponds to the transferred power of $S = 20$ kVA, $\varphi = -\pi/4$?

...to be filled in...

(b) Compare SV-PWM with CB-PWM with min/max signal injection, and with CB-PWM without zero sequence injection. Provide the relevant scope captures and discuss the observed waveforms.

...to be filled in...