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Control and protection of the HVDC/AC electrical grids

Assignment 1: MMC design and control

By: Dr. Aleksandra Lekić, TU Delft

1. MMC description

The MMC model and its inner and outer control loops are described in detail in the lectures and the reader following this lecture. For more information, please refer to the document “New Principles of Design and Operation for HVDC Grids.”

In this assignment, you will use formulas developed for the pole-placement proportional integral controller to properly design the control operation of the AC current and circulating current. For that, please refer to formulas (1.18) and (1.19) in the reader.

2. MATLAB library

In the MATLAB library are existing files:

- main.m – main file that runs the MMC model;
- dxdt.m – MATLAB function with differential equations of the MMC and its control loops.

By running the main file, the output is received in the format of the time domain diagrams of the MMC converter. Different control loops can be included, as can be seen from lines 9-14 in the main file by stating “true” or “false.”

3. Assignment

To finish this assignment, do the following tasks:

- Run the file main.m and plot the time domain diagrams with the current setting. Save the diagrams as a PDF file and explain the values in the steady state. Look especially for values for P, Q, DC voltage, and zero current. Are these values as desired?
- Comment lines 47-51 and uncomment lines 42-46 to change the desired operation of the converter. Do you get the desired steady state? Save the diagrams in the PDF, and explain them.