Paris Session 2022

Solid-State Transformer

SC B4 DC Systems and Power Electronics

PS3-2 Other Power Electronics Applications

Question 3.2

HANG LI, CANADA

ELECTRANIX
SPECIALISTS IN POWER SYSTEM STUDIES

Solid-State Transformer

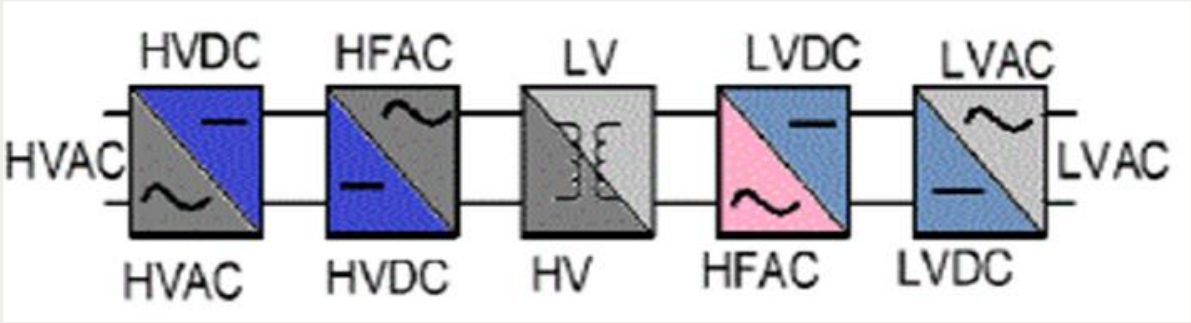

Figure 1
An example of commonly used SST structure [1]

- There are other types of SSTs being used or prototyped around the world
- The most common structure of SST is shown in Figure 1
  - Stage one: AC-DC conversion
  - Stage two: DC-DC conversion (DC-AC, AC-AC, AC-DC)
    - Dual active bridge (DAB)
  - Stage Three: DC-AC conversion
- Functions and features
  - Provides active and reactive power control
  - Provides voltage, phase, and frequency control including harmonics
  - Capable of bidirectional power flow with isolation

Solid-State Transformer

CATEGORY CAPABILITY	NC STATE[20]	MEGALINK[21]	UNIFLEX[22]	EPRI IUT[23]	CREE[24]
VOLTAGE	7.2 kV / 280 V	10 kV / 400 V	3.3 kV / 415 V	2.4 kV / 480 V	13.8 kV / 465 V
POWER RATING	20 kVA	1 MVA	300 kVA	45 kVA	1 MVA
OVERLOAD	Yes	Yes	Yes	Yes	Yes
HARMONICS COMPENSATOR	No	No	Yes	Yes	No

Figure 2
Harmonics and overload capabilities of SSTs mentioned in the roadmap [1]

- Filters or snubber circuits to minimize the impact of abnormal conditions
- Hybrid design with analog transformer alongside the SST
- Increasing the temperature rating of power module
- The overload and harmonics compensation capabilities of 5 SSTs covered in the roadmap [1]

[1] U.S. DOE Office of Electricity, *Solid State Power Substation Technology Roadmap*, June 2020