Master's Thesis:
Converter Contributions During Faults

Synne Garnås

Master of Energy and Environmental Engineering

Supervisor: Hans Kristian Høidalen, ELKRAFT

Norwegian University of Science and Technology

The scope of the thesis:

Investigate the short circuit current contribution from converters.

The problem:

Integration of distributed generation (DG) presents new challenges to the operation of the distribution networks, including changes in the short circuit current level and direction.

The hypothesis:

The short circuit current contribution from a converter, is negligible.

Approach

- Simulations in Simulink
- Tests on 60 kVA VSC in the Smart Grid Laboratory

Tests in the Smart Grid Laboratory

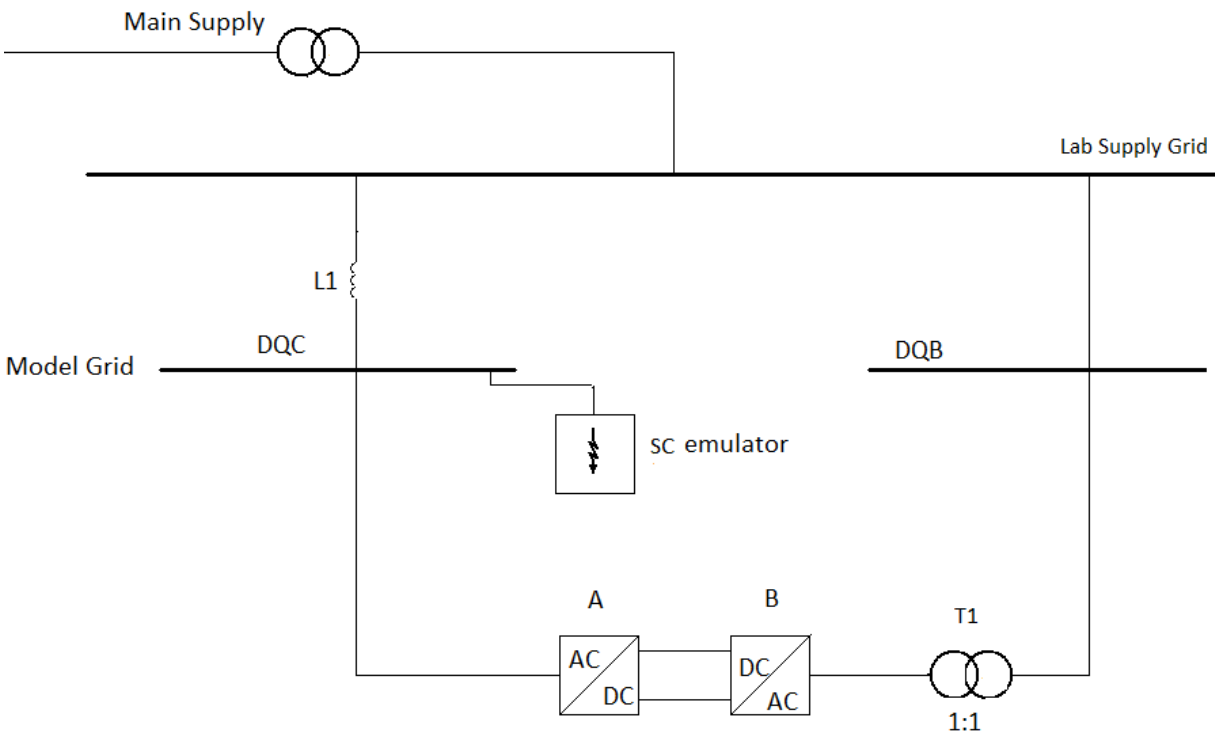

Figure 1: Sketch of the laboratory setup.

Table 1: Converter parameters

Parameter	Value
Power Rating	60 [kVA]
V_{DC}	600 [V]
V_{AC}	400 [V]
I_{rms}	100 [A]
L_{filter_1}	500 [μH]
L_{filter_2}	200 [μH]
C_{filter}	50 [μF]

Voltage Source Converter

Short Circuit Emulator

Results from two tests:

Test 1: With direct current control

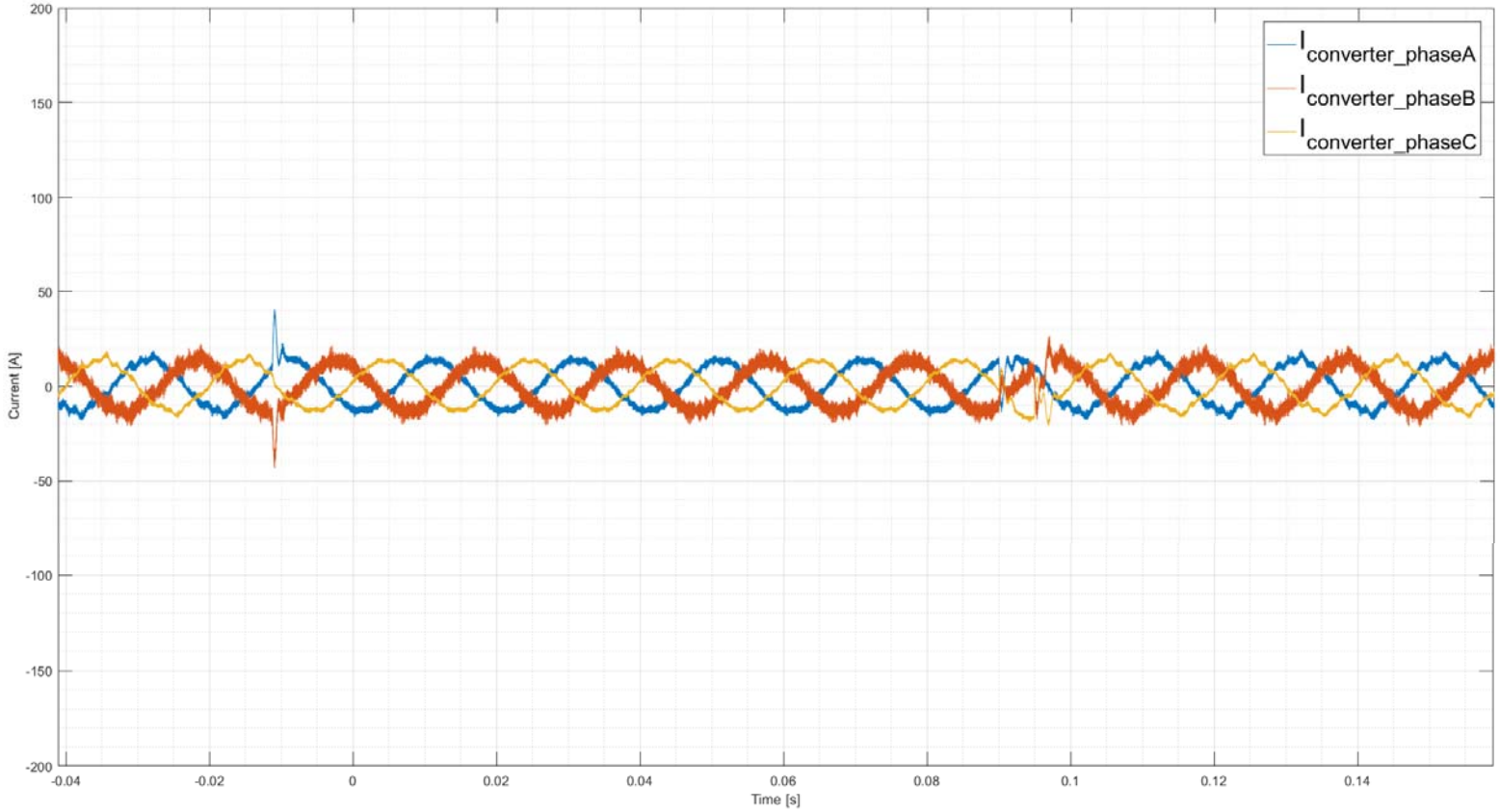

Figure 2: The converter current during a 100 ms three-phase short circuit, with direct current control.

Test 2: With AC voltage regulation

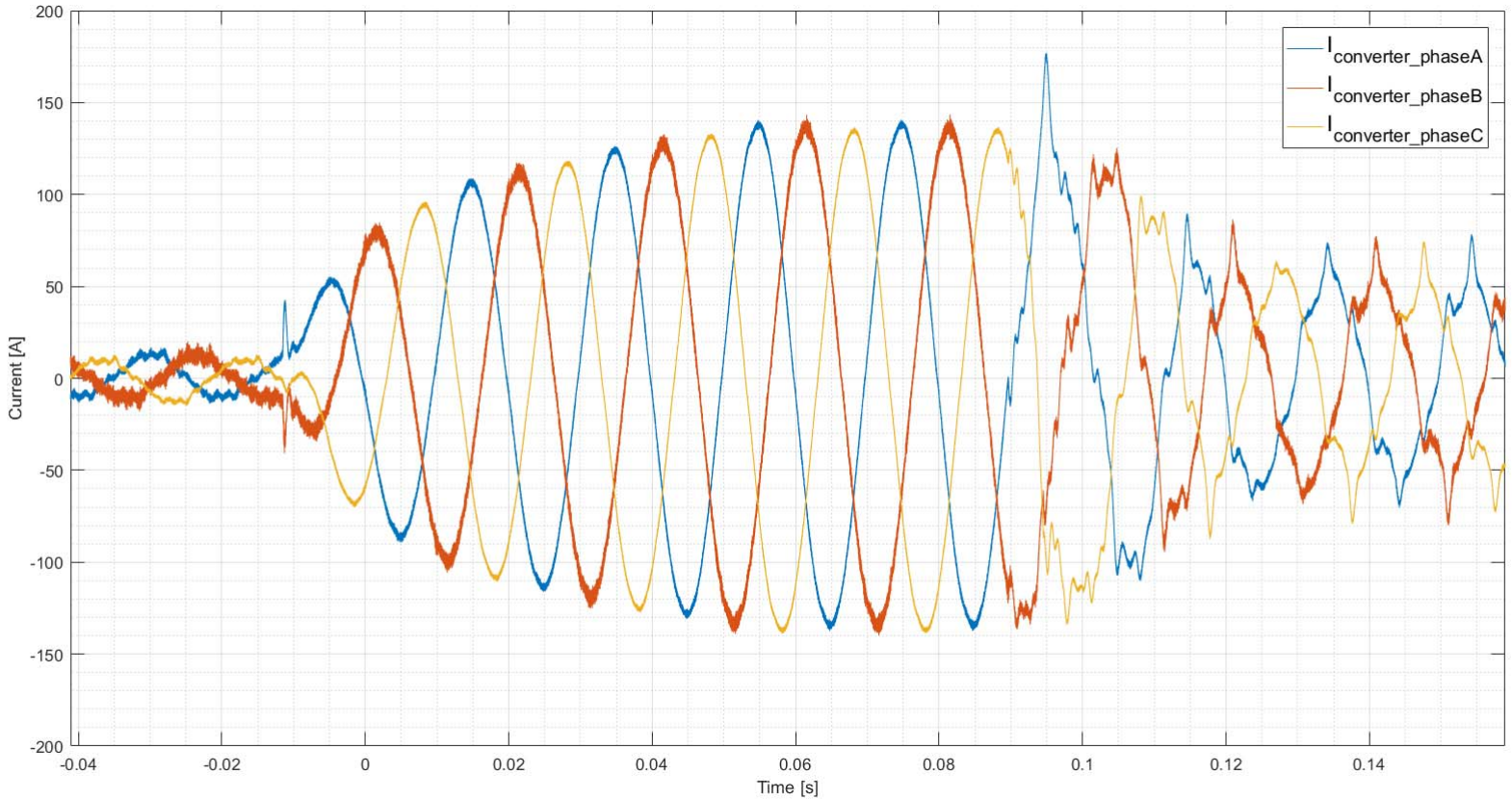

Figure 3: The converter current during a 100 ms three-phase short circuit, with AC voltage control.

Main finding

- The short circuit current behaviour depends on the implemented control.

- Still, more tests need to be performed to draw a general conclusion.

Test 1: With direct current control

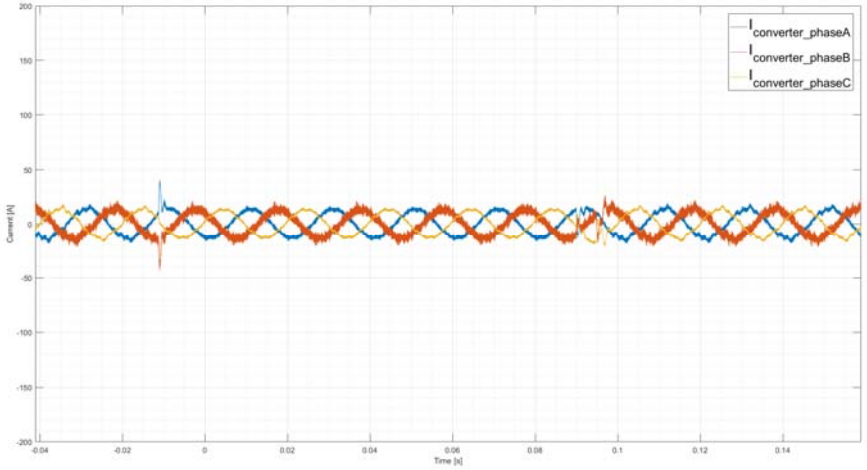

Figure 2: The converter current during a 100 ms three-phase short circuit, with direct current control.

Test 2: With AC voltage regulation

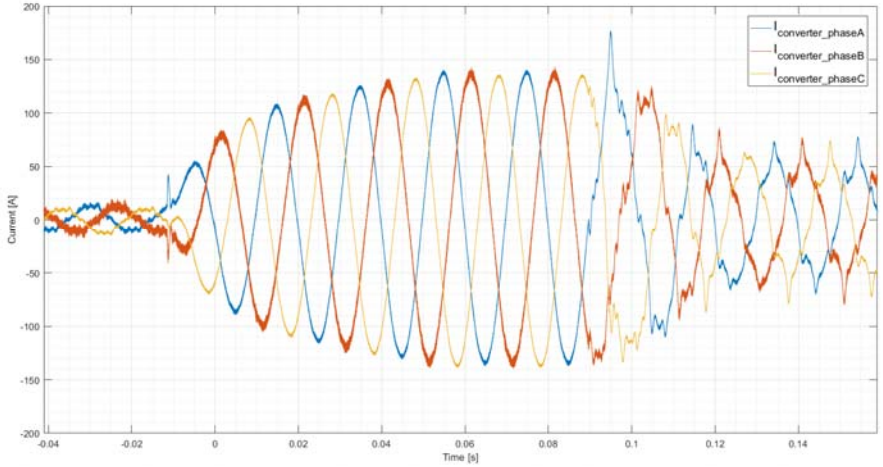

Figure 3: The converter current during a 100 ms three-phase short circuit, with AC voltage control.

Thank you for your attention!