

Cycle of studies: Master LM

Degree course: Energy Engineering

Title of the thesis: Study of voltage and current modulation in SPIDER RF generators

Type: Modelling, experimental

RFX Supervisor: Riccardo Casagrande

Academic supervisor: Prof. Paolo Bettini

Head of the RFX research group: Elena Gaio

Leader of the RFX research program: Vanni Toigo

Description of the thesis:

SPIDER is one of the experiments of the Neutral Beam Test Facility (NBTF), dedicated to the development of the Neutral Beam Injector (NBI) for ITER experimental reactor.

The plasma in SPIDER's negative ion source is produced by 8 radio-frequency (RF) drivers. Each segment of the source, formed by a pair of drivers, is powered by a solid-state amplifier, operating in the $1 \text{ MHz} \pm 80 \text{ kHz}$ frequency range. The segments are currently tuned to a similar working frequency, by means of an impedance matching network.

Since the first experiments with SPIDER, a modulation of voltage and current output from the generators has been observed, due to the inductive coupling between segments. The possible strategies to reduce the modulation are: iso-frequency operation of the generators, or modification of the matching networks to operate at suitably diversified frequencies.

The aim of the thesis is to identify the best strategy to limit the voltage and current modulation of the generators, by analyzing the equivalent RF circuits of SPIDER. The result of these analyzes will be useful in defining the optimal operating frequencies, and in evaluating the impact of modulation on the measurement systems of the output power from RF generators.

Previous experience: electrotechnics, basic knowledge of MATLAB or PYTHON, basic knowledge of Simulink

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Status: available

Name of the student: (when assigned)