DRF: Thesis SL-DRF-20-0692

RESEARCH FIELD

Electromagnetism - Electrical engineering / Sciences pour l'ingénieur

TITLE

Fusion superconducting cables coupling losses and induced instabilities: multiphysic modelling and experimental validation

ABSTRACT

Thermonuclear fusion is a domain bearing important objectives, particularly as linked with electricity production. The power produced in a tokamak requires superconducting magnets to enhance system power balance. The magnets operation stability is a major point since their resistive transition can induce severe issues (high stored magnetic energy dumped in the system). This transition derives from combined superconducting material properties under magnetization and the cable architecture (a complex assembly of thousands of strands). In the superconducting community the modelling of this phenomenon remains still of limited accuracy, imposing in the tokamak expensive margins and still un-mastered operational risks.

The PhD work targets enhancing the actual modelling of the physics phenomena triggering instabilities. The model available (COLISEUM) deals with thermo-magnetic effects representation in a cable and will be upgraded using both theoretical and experimental considerations. Applications will be conducted on real cable geometries (tomographic data). The resulting case runs will be confronted to experimental data from magnetization tests in cold conditions. Then predictive cases will be carried out on different tokamaks such as JT-60SA, ITER or DEMO.

LOCATION

Institut de recherche sur la fusion par confinement magnétique
Service Tokamak Exploitation et Pilotage
Groupe Cryomagnétisme
Place: Cadarache
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CONTACT PERSON

Louis ZANI
CEA
DRF/IRFM/STEP
CEA Cadarache
CEA/DRF/IRFM
Bat 513
13108 St Paul lez Durance
Phone number: +33 4 42 25 49 67
Email: louis.zani@cea.fr

UNIVERSITY / GRADUATE SCHOOL

Aix-Marseille Université

Sciences pour l'Ingénieur : Mécanique, Physique, Micro et Nanoélectronique - Aix-Marseille Université -

THESIS SUPERVISOR

Frédéric TOPIN

Université Aix-Marseille

IUSTI - CNRS UMR 6595

5, rue Enrico Fermi - Technopôle de Château Gombert - 13453