PhD in Information Technology and Electrical Engineering
Università degli Studi di Napoli Federico II

PhD Student: Andrea Antonione

Cycle: XXXIX

Training and Research Activities Report

Academic year: 2023-24 - PhD Year: First

Andrea Antonione

Tutor: prof. G. De Tommasi

Co-Tutor: G. Carannante

Date: October 31, 2024

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle: XXXIX **Author: Andrea Antonione**

1. Information:

- **PhD student:** **Andrea Antonione** **PhD Cycle:** **XXXIX**
- **DR number:** **997756**
- **Date of birth:** **12/07/1998**
- **Master Science degree:** **Physics** **University: Università degli Studi di Torino**
- **Scholarship type:** **no scholarship**
- **Tutor:** **G. De Tommasi**
- **Co-tutor:** **G. Carannante**
- **Period abroad:** ***Iter site***

2. Study and training activities:

Activity	Type[1]	Hours	Credits	Dates	Organizer	Certificate[2]
Gyrotron Physics and Thecnologies	Course	20	4	11/2023 – 12/2023	EPFL	N
AI for Plasma Control in Fusion Energy	Seminar	1	0.2	25/06/2024	AI for Good	N
Introduzione alla Teoria del Controllo	Course	48	6	11/04/2024 – 31/05/2024	ITEE Prof. M. Di Bernardo	Y
AI for Fusion Energy Challenge Finale: Multi-Machine Disruption Prediction	Seminar	1	0.2	Registered	AI for Good	N
Towards fusion energy with the help of AI	Seminar	2	0.4	Registered	AI for Good	N
AI for Fusion Energy Challenge	Seminar	1	0.2	Registered	AI for Good	N
Signal Processing with Simulink	Course	24	4	16-17-18 /10/2024	MathWorks Trainer J. Pinel	Y
Controlli Automatici	Course	36	6	Registered	ITEE Prof. L. Villani	N

1) Courses, Seminar, Doctoral School, Research, Tutorship
2) Choose: Y or N

2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	**4**		**6**		**10**
Bimonth 2			**10**		**10**
Bimonth 3			**10**		**10**
Bimonth 4		**0.2**	**10**		**10.2**
Bimonth 5	**6**	**0.8**	**3**		**9.8**
Bimonth 6	**10**				**10**
Total	**20**	**1**	**39**	**0**	**60**
Expected	**30 – 70**	**10 - 30**	**80 – 140**	**0 – 4.8**	

3. Research activity:

Topics:

- Development of a thermal lumped model for the magnetron injection gun of ITER European gyrotrons
- Model-based controller synthesis studies for gyrotron operational phases
- Data-driven mode loss detection to complement safeties

Methodologies:

- Data-driven optimization of the model
- Validation of the model against a dedicated dataset
- Mode loss classification via machine learning methods

Results:

- High accuracy in model optimization, suitable to synthetize controllers and to be implemented in the controller itself

4. Research products:

Article

A. Antonione, G. Carannante, M. G. Ferrari, K. Cindric, F. A. Sanchez, A. Leggieri, G. De Tommasi
Development and Benchmarking of a Thermal Lumped Model for the Magnetron Injection Gun of the MW-Power ITER European Gyrotron
submitted to Nuclear Fusion

5. Conferences and seminars attended

6. Periods abroad and/or in international research institutions

7. Tutorship

8. Plan for year two

- Further development of the thermal lumped model
- Controller synthesis and tests at FALCON test facility, Swiss Plasma Centre
- Mode loss detection algorithm development
- PhD school *Control and Operation of Tokamaks* (EPFL)