



NATIONAL PH.D. PROGRAM IN AUTONOMOUS SYSTEMS

Emergent behaviors in opinion dynamics

Ph.D. candidate

Amirhossein GHORBANSARVI

Cycle

XXXVIII cycle

Tutors

Prof. Francesco Vasca

1. Description of the research program

The research project is the area of analysis of dynamic social networks through graph theory. Dynamic interconnected systems can be represented as switching networks whose paradigm is applicable in different sectors. Opinion dynamics are characterized by relationships between autonomous agents each with its own state dynamics, with connections that depend on the relative distance between the respective state variables. The dynamic behaviour is determined by the commutations of the links between the nodes of the network. For this class of systems, network analysis requires advanced modelling and control techniques: from hybrid systems to averaging techniques, from Lyapunov stability to dynamic graphs. The project intends to deepen the aforementioned methodologies, drawing inspiration from applications for the dynamics of opinions in social networks.

2. Schedule of the research activities

First academic year (planned)

	Description	Period	Activity abroad
Study of the relevant literature	Analysis of the state of art on opinion dynamics and graph theory	1-6	YES (waiting for the VISA from Iran)
Models for opinion dynamics	Study of the bounded confidence opinion dynamics and the relevant emergent dynamic and steady state behaviours	6-12	NO

Second academic year (planned)

	Description	Period	Activity abroad
Application domain	Selection of the application domain for the analysis of opinion dynamics and corresponding data analysis	1-12	NO
Methods for steady-state analysis	Study of the most proper methods for the analysis of the typical steady state behaviours of opinion dynamics, e.g. consensus and clustering	1-12	NO

Third academic year (planned)

	Description	Period	Activity abroad
Model for real data representation	Application of real data set to models of opinion dynamics	1-12	YES (visit at the University of Linköping in Sweden, prof. Claudio Altafini)
Validation	Numerical validation of the theoretical results	1-12	YES (as above)

3. Training and research activities plan

First academic year (planned)

	Description	Period	Final Exam	ECTS
A. Ph.D. courses	DAUSY course (to be decided)	1-12	Yes	6
B. Master's degree courses	Advanced Control (University of Sannio)	6-12	Yes	9
C. Soft skill courses				
D. Participation to seminars	Participation to at least 2 seminars	6-12		1
E. Participation to international congresses or workshops				
F. Presentation of research products at international congresses or workshops				
TOTAL OF ECTS FOR TRAINING ACTIVITIES				16
G. Individual research activity	Research activity in the topics of graph theory and opinion dynamics	1-12		26
H. Supervision of students	Supervision of Students under the guidance of the tutor	8-12		3
I. Integrative teaching activities	Integrative didactic activities to be carried out under the supervision of the tutor	6-12		5
J. Preparation of manuscripts for conferences or journals	Verbalization of the results obtained, in the form of a paper for a conference or a journal.	6-12		10
TOTAL OF ECTS FOR RESEARCH ACTIVITIES				44
TOTAL OF ECTS				60

Second academic year (planned)

	Description	Period	Final Exam	ECTS
A. Ph.D. courses	DAUSY course (to be decided)	1-12	Yes	6
B. Master's degree courses	Multiagent systems (University of Sannio)	6-12	Yes	9
C. Soft skill courses				
D. Participation to seminars	Participation to at least 2 seminars	1-12		1
E. Participation to international congresses or workshops				
F. Presentation of research products at international				

congresses or workshops				
	TOTAL OF ECTS FOR TRAINING ACTIVITIES			16
G. Individual research activity	Research activity in the topics of graph theory and opinion dynamics	1-12		26
H. Supervision of students	Supervision of Students under the guidance of the tutor	1-12		3
I. Integrative teaching activities	Integrative didactic activities to be carried out under the supervision of the tutor	1-12		5
J. Preparation of manuscripts for conferences or journals	Verbalization of the results obtained, in the form of a paper for a conference or a journal.	1-12		10
	TOTAL OF ECTS FOR RESEARCH ACTIVITIES			44
	TOTAL OF ECTS			60

Third academic year (planned)

	Description	Period	Final Exam	ECTS
A. Ph.D. courses	Course at the University of Linköping (to be decided)	1-12	Yes	6
B. Master's degree courses				
C. Soft skill courses				
D. Participation to seminars	Participation to at least 2 seminars	1-12		1
E. Participation to international congresses or workshops	Participation to an international congress or workshop according to availability.	1-12		1
F. Presentation of research products at international congresses or workshops	Presentation of the results obtained to at least one international congress or workshop associated to a high impact factor	1-12		2
	TOTAL OF ECTS FOR TRAINING ACTIVITIES			10
G. Individual research activity	Research activity in the topics of graph theory and opinion dynamics	1-12		32
H. Supervision of students	Supervision of Students under the guidance of the tutor	8-12		3
I. Integrative teaching activities	Integrative didactic activities to be carried out under the supervision of the tutor	6-12		5
J. Preparation of manuscripts for conferences or journals	Verbalization of the results obtained, in the form of a paper for a conference or a journal.	6-12		10
	TOTAL OF ECTS FOR RESEARCH ACTIVITIES			50
	TOTAL OF ECTS			60

4. List of the publications written by the candidate in the triennium

None.

Amirhossein Ghorbansarvi

Prof. Francesco Vasca
