

Allegato A PROGETTO Scienza senza Frontiere – Brasile

Name of the doctoral program

Mathematics For Engineering Sciences

Cotutelle X

Title of the research activity

Mathematical Methods and Models for Complex Systems

Short description of the research activity

The PhD Program focuses on the development of mathematical tools for the modeling, qualitative analysis and simulations of large systems of living, hence complex, entities interacting in a nonlinear manner. The methodological approach is finalized to the study of a specific system selected within the domain of expertise of the SIMAI Activity Group on Complex Systems. Namely: vehicular traffic, crowds and swarms, multiscale problems for multicellular systems, socio-economical systems.

The program acknowledges that the study of complex systems has received in recent years a remarkable increase of interest among applied mathematicians, physicists as well as researchers in various other fields as economy or social sciences. Their collective overall behavior is determined by the dynamics of their interactions. On the other hand, a traditional modeling of individual dynamics does not lead in a straightforward way to a mathematical description of collective emerging behaviors. In particular, it is very difficult to understand and model these systems based on the sole description of the dynamics and interactions of a few individual entities localized in space and time.

The PhD student will be encouraged to scientific interchanges at European level. The existing interplays with Brazil are: Jorge Zubelli IMPA and Jose' Fernando Fontanari San Paulo.

Further motivations can be found in "Awareness Message" of the Americal mathematical Society "Unraveling Complex Systems": We are surrounded by complex systems. Familiar examples include power grids, transportation systems, financial markets, the Internet, and structures underlying everything from the environment to cells in our bodies. Mathematics and statistics can guide us in understanding these systems in enhancing their reliability and improving their performance. (From <http://www.mathaware.org>)

Scientific responsible (name, surname, role)

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The supervising will refer to the Activity Group on Complex Systems of SIMAI (Italian Society of Applied and Industrial Mathematics) www.simai.eu

Number of vacancies for XXVIII cycle (begin January 2013)

2

Specific requirements (experiences, skills)

Mathematical foundations of ordinary and partial differential equations

Website of the research group (if any)

<http://calvino.polito.it/fismat/poli>