complexys

Institute for Research on Complex Systems

The COMPLEXYS Institute has developed expertise in the modelling and simulation of complex systems, such as biological, physical and economic systems, through new mathematical models and dedicated software. Their success is based on the collaboration of computer scientists, mathematicians and specialists in the sciences studied.

MATHEMATICAL MODELS AND SOFTWARE

The computer scientists and mathematicians of the COMPLEXYS Institute are specialised in:

- Information modelling and communication systems (software, databases, networks, etc;
- The development of tools and techniques for: numerical analysis, dynamical systems, probability and statistics, graph theory, game theory, operations research, automata theory and mathematical logic.

SPECIALISTS IN SCIENCE

These experts study different themes, such as :

- light interactions in complex materials (photonics and plasmonics),
- multi-scale modelling of structures and materials with optoelectronic properties,
- behaviour of liquids at interfaces
- the creation of new thin film architectures (filaments, plates and shells)
- the mechanisms of the cytoskeleton of a cell
- the creation of organs by living organisms
- etc.

145 researchers

40 PhD Students

250 publications per year

30 ongoing projects

Contact

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Artificial Reef Mesocosms Study of the effects of major climate change on tropical corals in simulated artificial ecosystems.

Carbochemostats: research bioreactors allowing the precise measurement of C, O, N and P fluxes between the biological system studied and its surrounding environment (original and patented concept n° U.K. WO 2013/010764 A1)
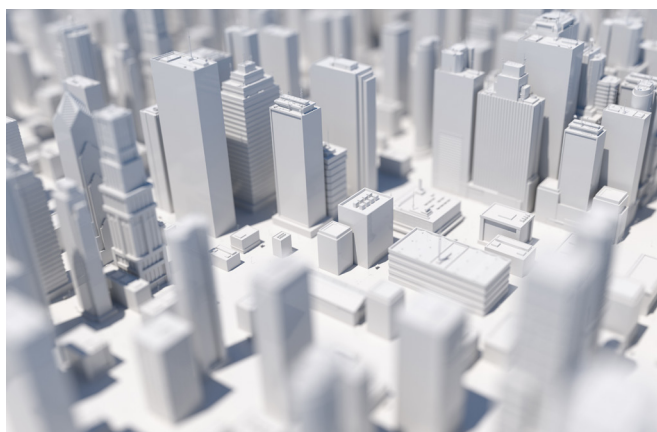
MANYSYNTH
(FNRS / MIS)

The ManySynth (Many-sided Synthesis of Reactive Systems: Foundations, Algorithms and Tools) project aims to improve the reliability and safety of reactive systems (e.g. embedded software ubiquitous in our lives) through the development of mathematical theories and software tools supporting the verification and automated synthesis of correct systems through construction, with a focus on multi-objective models.

SECO ASSIST
(FNRS+FWO / EoS)

Software ecosystems are the most promising way to organise the software needs of the digital age. SECO-ASSIST aims to achieve a scientific breakthrough in supporting the ecosystems of the future, by developing new software recommendation techniques that consider resilience, scalability, heterogeneity and social interactions. To this end, the project partners will combine their expertise in social networks (UMONS), software testing (UAntwerpen), software reuse (VUB) and database evolution (UNamur).

HSGRA
(FNRS)

At the heart of black holes, gravitation and quantum mechanics can no longer ignore each other. The HSGRA (Higher Spin GRAvity) project is pursuing a path that aims to extend Einstein's general theory of relativity to obtain a theory of gravitation that allows a happy marriage with quantum mechanics.

COMOD
(FWB / ARC)

In view of current ecological problems, the notion of compactness has become essential to ensuring the sustainable and positive development of our cities, thus limiting the abusive use of natural spaces and preserving biodiversity in the face of the economic and social challenges of the territories.

How can we create cities that sufficiently meet strong compactness criteria to reduce their consumption without harming their attractiveness or quality of life?

The specificity of the CoMod project is that it proposes to study this notion of a «compact city» with the help of graph theory and to approach the problems linked to the arbitration of the various criteria relating to it from the perspective of game theory.

COMPLEXYS researchers develop specialised open-source software tools as part of their research on complex systems and, on a subcontracting basis, meet the specific needs of industrialists or other organisations requiring adapted software solutions.

- A remarkable example is the Zoo/phytoimage software developed by the Laboratory of Digital Ecology of Aquatic Environments, which analyses plankton from digitised images.

- Another example is the Sismic software, an open-source library that allows the simulation, execution and testing of behavioural models in the form of state charts. This tool is already being used by several companies and has been published in a scientific journal.