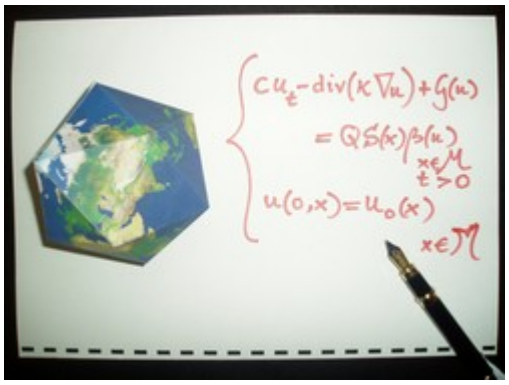
Fronts and Interfaces in Science and Technology

Results in Brief

Nonlinear equations: Solvability, uniqueness or bifurcation and stability

Scientists and engineers need to model the real world and solve the resulting set of mathematical equations. An EU-funded consortium has expanded the range of nonlinear phenomena that can be explored mathematically.

FUNDAMENTAL RESEARCH



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Different areas of science and technology (S&T) are increasingly intersecting at a number of topics, giving researchers new frontiers to explore. One of these areas is non-linear partial differential equations (NL-PDEs). A powerful tool for gaining insight into real-world physical processes such as climate change and desertification, NL-PDEs could suggest directions for future research.

The EU-funded project FIRST (Fronts and interfaces in science and technology) brought together engineers and mathematicians to solve complex systems of NL-PDEs. These could help scientists' to accurately display phenomena involving hysteresis, delay or long-range-interaction effects.

Focusing on the exchange of knowledge and expertise, the project consortium spanned eight universities that were offering specialised courses in relevant topics.

The presence of two industrial partners broadened the range of topics covered. The FIRST project focused on applications ranging from image processing to interfaces and fronts in emerging technology problems.

The training activities offered were not limited to a set of courses available in graduate programmes but also specialised workshops open to the European scientific community. To complement the FIRST consortium's capacity to supervise the training activities and to transfer as well as generate new knowledge, six senior scientists were recruited.

Research work within the FIRST project drove mathematical developments in non-local and higher-order problems, as well as the stochastic analysis of multiscale methods, among other topics. The findings have already been described in detail in a series of scientific publications and presented at numerous international conferences.

More importantly, a better understanding of mathematics playing a central role in nonlinear science has emerged from the FIRST project. The symbiotic interplay between experimental and theoretical mathematics is expected in the future to contribute to the solution of previously intractable nonlinear studies.

Keywords

Nonlinear phenomena, science and technology, partial differential equations, climate change, multiscale methods

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Project Information

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