Editorial

In times past, scientific activity would be carried out according to two modes: theory, and experimentation. The past few decades have seen numerical simulation gain acceptance as a third approach, in most disciplines involved in research and development, from the most fundamental to those closest to industrial concerns. Concurrently, thanks in part to simulation, predictive science has surged ahead, making inroads in the preserve of empiricism. Which has in no way put experimentation in jeopardy, since there can be no valid prediction without identification and modeling of processes, by way of experiments where precision and sensitivity of measurements and accuracy of sensors play an increasingly crucial role.

The triptych made up of modeling/simulation/experimentation has thus asserted itself as the backbone of the R&D process, sustained by advances in computers and software engineering, making it possible to use their extraordinary capabilities to the best advantage. Computing power now available allows, nowadays, a numerical approach – previously unthinkable – for complex phenomena.

CEA has acted, and is acting more than ever, as prime mover in this evolution, in particular so as to meet requirements related to production of the components of the French nuclear deterrent, and of the French nuclear power reactor fleet. Its work in the life and physical sciences, as well as in technological research, has also followed, or at times even anticipated, this trend. It was thus a natural move to devote an issue of *Clefs CEA* to an approach which has profoundly altered the professions of researcher, engineer, and, more generally, of practitioners as a whole.

More widely, pursuit of major current society-wide goals requires, more than ever, recourse to simulation. Whether the issue be *understanding* or prediction of climate evolution, *design* of new medical cures, of diagnostic resources, of energy systems taking on board the concept of sustainable development, or *action* and taking the right decision in difficult circumstances, the indissoluble whole of theory/modeling, numerical simulation, and experimentation is ubiquitous.

At the same time, experimentation may be restricted, in quantitative terms, with no risk of passing over major aspects, through use of behavioral modeling, as outlined in this issue. The taxpayer will reap the benefit, more readily even than the consumer or the citizen, for the "returns" from ever-costly equipment are greatly increased, due to "smarter" and faster research, as shown by the example of genetics. As for past integral experiments – this now being the case with regard to nuclear tests – they may now be revisited in the light of the latest advances in research, and findings from the new tools of simulation, making it possible to qualify the latter.

Bernard Bouquin

Review published by the
Commissariat à l'énergie atomique
Communication and Public Affairs Division
31–33, rue de la Fédération
75752 Paris Cedex 15 (France)
Phone: + 33 (0)1.40.56.10.00

CEA website:
http://www.cea.fr

Executive Publisher
Philippe Bergeonneau

Editor in Chief
Bernard Bouquin

Deputy Editor
Martine Trocellier

Production follow-up
Lucia Le Clech

Secretariat, illustrations
Marceline Pac

Contributors to this issue:
Didier Besnard, Étienne Klein, Nathalie Manaud, Alain Mathiot, Thierry N'kaoua

ISSN 0298-6248
Commission paritaire No. 2 037 ADEP

Design of electronic media:
Calathea – Paris –
Phone: + 33 (0)1.43.38.16.16

Translated into English by Technicis
Revised by Jean-François Roberts

ISSN 1625-9718
Clefs CEA (on line)

Subscription
Subscription (printed French version) to *Clefs CEA* (six issues) is free and renewable.

Requests should be addressed preferably by fax to:
CEA/Direction de la communication et des affaires publiques
Abonnements *Clefs CEA*
31–33, rue de la Fédération
75752 Paris Cedex 15 (France)
Fax: + 33 (0)1.40.56.20.01
Phone: + 33 (0)1.40.56.11.07