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New European Training Network to Improve Young Scientists' Capabilities in Computational Wave Propagation

The European Commission recently funded a Marie-Curie Research Training Network (MCRTN) in the field of computational seismology within the 6th Framework Program. SPICE (Seismic wave Propagation and Imaging in Complex media: a European network) is coordinated by the computational seismology group of the Ludwig-Maximilians-Universität in Munich linking 14 European research institutions in total.

The 4-year project will provide funding for 14 Ph.D. students (3-year projects) and 14 postdoctoral positions (2-year projects) within the various fields of computational seismology. These positions have been advertised and are currently being filled.

The theory and applications of acoustic (elastic, seismic) wave propagation are entering a new era in fields such as seismology, oceanography, meteorology, acoustics, engineering, material sciences, medical sciences, and others. In the past 10 years, the methodologies used in these fields have converged due to the extensive use of numerical methods. Modern computational techniques, in combination with parallel computer architectures afford the simulation of the complete three-dimensional phenomena of wave propagation for realistic complex structures with unprecedented detail. This suggests that the inverse processes (e.g., imaging of the Earth's internal structure, physical description of hydrocarbon reservoirs, monitoring of zones of weakness in constructions, characterization of earthquake rupture processes, etc.) will experience a quantum jump in resolution and accuracy over the next decade. The SPICE network aims at integrating institutions with specializations in physical, mathematical, geological, and computational aspects of wave propagation. The goal is to develop, verify, apply, and store computational tools for wave propagation and imaging problems on all scales (e.g., laboratory, local, regional, global).

Although it seems obvious that computational methodologies play an increasingly important role in Earth sciences, the curricula do not provide the required teaching to equip young scientists with the necessary background in mathematical and computational aspects of a rapidly expanding field. The goal of the SPICE network is to partly compensate for this and to provide open training facilities in the field of computational wave propagation. This will be achieved by yearly training courses involving the network team and leading scientists in the associated fields of research. In addition, a Web-based library with teaching and training material will be developed.

The SPICE project was started with a kick-off meeting held in a mountain resort in the Bavarian Alps, Sudelfeld, 18-21 January, 2004. About 40 scientists from the network institutions as well as from the exploration industry (Schlumberger) and the European seismic data center (ORFEUS) met to further define scientific and technical goals of the project. The network defined 5 task groups that will organize the research according to the spatial scales involved (small - reservoirs and volcanoes; local - earthquake scenarios, dynamic rupture; planetary - global wave propagation and tomography), as well as

more technical tasks (electronic library - teaching material, code repository, simulation results; and workshop organization).

It is fair to say that the sophistication of synthetic (theoretical) simulation data is steadily increasing, and that the data are becoming as valuable as observations. Yet, while there is substantial infrastructure and data standards for observations in seismology, no such standards exist for theoretical data. It was decided that the development of such standards should be carried out in close collaboration with the seismic data centers (e.g. ORFEUS, IRIS). As similar initiatives are being pursued in the United States and elsewhere we aim to join forces in this direction.

The first open research and training workshop in computational seismology will take place 25 September - 2 October 2004 at the Venice International University in Italy. The focus of this workshop will be training in the various numerical techniques used in computational wave propagation (e.g., finite differences, finite-spectral elements, finite volumes). Scholarships will be available for students and can be applied for through the project Web pages. Subsequent research and training workshops will focus on specific applications in seismology and large-scale computations (2005), inverse problems (2006), and an interdisciplinary workshop (2007).

The 14 participating institutions are: Department of Earth and Environmental Sciences, Ludwig-Maximilians-Universität, Munich, and Institute of Geophysics, University of Hamburg; Institut de Physique du Globe, and Department of Earth and Environmental Sciences, École Normale Supérieure, Paris; Istituto Nazionale di Geofisica e Vulcanologia, Rome, and Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Trieste; Department of Physics, University of Naples "Federico II"; Department of Earth Sciences, University of Oxford; Faculty of Earth Sciences, University of Utrecht; Department of Earth Sciences, Swiss Federal Institute of Technology, Zurich; Department of Physics of the Earth and Planets, Comenius University, Bratislava; Geology Institute, University of Oslo; Department of Geology, National University of Ireland, Dublin; and Department of Geophysics, Charles University, Prague.

More information is available on the project Web pages at www.spice-rtn.org.

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