

Training and Collaborative Activities in the European Atelier for Engineering and Computational Sciences EUA4X

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In this paper we would like to introduce aims, training and collaborative activities characterising the *European Atelier for Engineering and Computational Sciences*, **EUA4X**, a three year project (2005-2007) financed by *European Union Marie Curie Conferences and Training Courses* (Contract # MSCF-CT-2004-013336). We focus on the activities and events, whose organization and implementation are in charge to CNR-IAC, dealing with dissemination and structuring of knowledge in numerical grid generation and computational field simulation.

We refer to Applied Scientific Computing (ASC) meaning those collections of computational approaches, centrally referred to PDE modelling and approximation, which combine numerical methods and information technologies, and lead to new processes for the investigation of complex phenomena in several application areas of Engineering and Computational Sciences (X). Most of industrial design processes, or environmental or biomedical investigations take advantage of simulation environments. Those technological advanced working environments, where it is possible to conceive an idea, determine its feasibility or validation, and characterise operational and/or physical performances without producing anything more than computer models. Indeed most industrial processes use computer modelling. For instance the design and performance evaluation of a new bioengineering component or most of the physics investigations, from the starting hypothesis governing a phenomenon to the human interpretation of simulation data, use computer prototyping in simulation environments.

ASC combines computational approaches coming from the numerical grid generation, partial differential equations (PDEs) or functional modelling, numerical approximation, both interactive and automatic integrated computing processes, along with scientific visualization and other complementary techniques. This area is characterized by new and day-by-day evolving technologies, where the development of human knowledge and resources is an on-going process, usually evolving outside the public education establishments all over Europe.

Among the concurring approaches to ASC, the numerical grid generation (NGG) is the starting step of computational modelling by partial differential equations (PDEs) so that its appropriate and advanced carrying out is fundamental to achieve accurate solutions and effective problem processing [3]. The generation of optimized discretizations of physical domains is the central core of any simulation process in several application fields, therefore efforts in research and training are welcome from a large spectrum of applied research communities.

There is a fragmented and, in some cases, a lack of training materials, and we need a frame addressing the different disciplines and methods in a consistent way both with respect to the demand of the labour market of the sector and to the possibility for the individuals to achieve personal fulfilment at all levels of their actual or potential employment. This is an area where the proposal of an *Atelier for Applied Scientific Computing* with a high-level and well-planned training programme is providing new and effective practical approaches in vocational training.

On the other hand the large X-Community needs training networks able to provide a coherent series of events to disseminate expertise on basic advanced technologies of computational modelling and their practical applications.

World future life presents problems that are every day recognized to be fundamental for the new generations. For instance the water and pollution problems are going on to be fundamental and become more and more central for the human life. We can say that as the magnitude of the contamination problem to subsurface water resources or to marine areas becomes more serious, scientists must give answers to the need to capture the physics of relevant processes. Therefore the development of knowledge and training actions on the mathematic and numerical modelling looks fundamental since renewing expertise by transferring it to young researchers could lead to catch still hidden important information on relevant phenomena and achieve new practical advantages.

EUA4X Aims and Programme

The **EUA4X** Series of Events is designed to promote the training of junior researchers and knowledge assessment and structuring by senior academics and practitioners in the area of Applied Scientific Computing and its applications. The **EUA4X** programme combines a set of 23 complementary events, including both conference-style events and training courses, lecture series and workshops, and online collaborative activities. They are planned to allow participants, in particular early-stage researchers, to experiment and share different but fundamental moments of the life of scientific and technical communities in an integrated framework. Event contents deal with both enabling technologies and their application to scientific areas that are crucial for societal developments. Indeed the proposed combination of events allow participant researchers to benefit of distinct but complementary atmospheres:

- **training courses** where eligible participants meet expert staffs and gain new skills at the class level, taking advantage of opportunities to establish day-by-day personal relationships and execute research activities in a staff-supervised environment;
- **lecture series/workshops** where participants, as well as academic and industry experts, present their recent results and discuss approaches and methodologies for the solution of application problems, and have access to a stimulating environment for scientific and technical exchange;
- **conferences** where eligible researchers meet communities representatives and leading experts coming from both Europe and USA, having different research and working experiences, and experiment the research life at the level of community meeting; access the community know-how, earn high-level best practices and possibly establish personal relationships with leading researchers.

Specific **virtual events** have been planned, and a few already started, in **EUA4X**. Exploiting experience in e-learning in scientific and technical disciplines of the project coordinator, TCN, and expertise in the development of user-friendly interaction at IAC, actions have been paralleled for the the realization of collaborative web sites and virtual events as permanent tools provided by the project. Aim is making accessible to wider audience, during the project and far beyond its completion, material of the courses, workshops and the conference activities of the programme, including on-line coverage of the major events. In particular we activated a **Dictionary in Numerical Grid Generation**, in MediaWiki environment for knowledge structuring by a collaborative **virtual open forum**.

CNR-IAC Past, Current and Future Events

The CNR-IAC is partner for the implementation of the Atelier and is in charge for the organization of five events, two already held, and we can say successfully, two scheduled for next October, plus one on-line currently holding:

Event#2 - Virtual Event-CNRI.VE.1- (EUA4X#2)
NGG Dictionary Open Forum – Numerical Grid Generation Wiktionary
Online monthly meeting <http://alice.iac.rm.cnr.it/eua4xiac>

Event#6 - Conference-CNRIAC.C1- (EUA4X#6)
EUA Computational Field Simulation Days I
Paris, July 2005, Guest Event in IMACS 2005

Event#8 - Training Course-CNRIAC.TC.1 (EUA4X#8)
State of the Art in Numerical Grid Generation I- From Theory to Practice
Lecce, October 2005, Joint in TCNCAE2005 and MASCOT05,

Event#19 - Conference-CNRIAC.C2- (EUA4X#19)
EUA Computational Field Simulation Days II
Rome, October 5-6, 2006, Joining MASCOT06,

Event#21 - Training Course-CNRIAC.TC.1 (EUA4X#21)
State of the Art in Numerical Grid Generation II- From Theory to Practice
Joining MASCOT06, Lecce, October 2-6, 2006.

Therefore we planned the organization of two training courses focused on NGG and its applications, two conference-style meetings completely multi-disciplinary and a working group for the assessment and structuring of knowledge in NGG and its applications.

Both events#6 and 8 have been held according to the above programme. Each event programme and location, as joint event in international conference, are very innovative respect to classically organized educational events. Lectured or contributed communications, and conference life have been combined as an integrated whole to be experimented by the participants.

Several scientific communities, such as the *International Association for Mathematics and Computers in Simulation* (IMACS) and the *International Societies of Grid Generation* (ISGG), and the Italian *Gruppo Nazionale di Calcolo Scientifico* (GNCS), and the *Societa' Italiana per la Matematica Applicata e Industriale* (SIMAI), were very interested and gave recognition to these events by announcing them on web sites and newsletters, expressing their interest in joining and cooperating to the Atelier activities.

According to the eligibility rules there were 40 funded participations coming from 15 countries in and outside Europe, well representing the international computational community. Most participants were less than 4 year research practitioners and a few had their first chance to join international conferences. Evaluation and balancing of both events have been reported in [1,2].

The two analogous next events EUA4X#19 and 21, will be held in Rome, at IAC, the first week of next October. Material about these event are available at both the web site of the coordinator and the partner CNR-IAC:

<http://www.eua4x.net>

<http://alice.iac.rm.cnr.it/eua4xiac>.

Indeed we designed collaborative web sites in Plone which is a free, open source Content Management System, to allow easy creation, publishing and retrieval of EUA4X contents in training and scientific knowledge.

The basic aim of the Virtual Event, EUA4X#2, is to provide and experiment a forum to discuss scientific knowledge in numerical grid generation. Ranging from theoretical to application approaches, participants are asked to act as main *contributors* and *reviewers* of the knowledge development and structuring processes which will lead to prototype an on-line *dictionary of the numerical grid generation*.

The *virtual open forum* in collaborative Plone environment has been designed to activate a community which will be working to arrange and provide well defined concepts and terminology in numerical grid generation, related to structured and unstructured grids or mixed approaches, to grid quality investigation and adaption, starting from basic concepts to more advanced definitions by collaborative network exchanges.

Even the *Numerical Grid Generation Wiktionary*, that is the on-line Dictionary in Numerical Grid Generation, was born on March 25 and a first small set of articles, that si terminology content and structuring categories in the numerical grid generation and its applications, is available to test capabilities. Main activity will be scheduled in on-line two-days meetings once a month. Participants, from their own locations, will become members of the Virtual Event Community by registering at the web site above, in the user friendly content management environment offered by Plone or strightly to MediaWiki at:
<http://alice.iac.rm.cnr.it:8080/wiki>.

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