ESF and Mathematics in Europe

The European Science Foundation (ESF), http://www.esf.org, is an independent organisation based in Strasbourg aiming to Advance European research in all areas and to explore new directions of research at the European level. The ESF covers Humanities, Life, Earth and Environmental Sciences, Medical Sciences, Physical and Engineering Sciences and Social Sciences and represents an important interface through its membership, currently 78 different research organisations in 30 countries, extending beyond the borders of the European Union.

The activities of ESF that are more relevant to Mathematics, that is currently among the Physical and Engineering Sciences, are Research Networking Programmes, ESF Research Conferences, the Forward Looks and Exploratory Workshops. These are aimed to provide foresight and advice on science, research infrastructure and science policy issues.

For instance, a recent ESF Exploratory Workshop on "Curves Coding Theory and Cryptography", was held in Marseille, France last March. According to its abstract, "Algebraic curves entered into coding theory in the 1980's with Goppa's introduction of algebraic geometric codes. The proposal of elliptic curves for use in cryptography by Koblitz and Miller in 1985 culminated new elliptic curve-based cryptographic U.S. government standards in 2005. This workshop united researchers actively working on the computational aspects of curves, in order to explore interdisciplinary research and applications to coding theory and cryptography." This topic was recently highlighted in the ESF website as "Mathematical advances strengthen IT security", that recognised the potential importance of the mathematical theory of elliptic curves as a leading candidate for more efficient cryptography than the RSA cryptosystem, introduced by Rivest, Shamir, and Adlement in 1977. Quoting David Kohel, the convenor of the ESF workshop "the size of the parameters (essentially the key size) for elliptic curve cryptography (ECC) needed to ensure security (under our current state of understanding) is much lower for ECC than for RSA or ElGamal (another alternative cryptographic method)", so the advantage of elliptic curve cryptography lies in its immunity to the specialised attacks that have eroded the strength of RSA, with the result that smaller keys can be used to provide a given level of protection.

Research Networking Programmes

In 2009 ESF has 9 Programmes strongly related to Mathematics, among the 31 Programmes in the list of Physical and Engineering Sciences, with the following titles and durations:

- Interactions of Low-Dimensional Topology and Geometry with Mathematical Physics (2009-2014);
- New Frontiers of Infinity: Mathematical, Philosophical and Computational Prospects (2009-2014);
- Optimization with PDE Constraints (2008-2013);
- Harmonic and Complex Analysis and its Applications (2007-2012);
- Quantum Geometry and Quantum Gravity (2006-2011);
- Automata: from Mathematics to Applications (2005-2010);
- Advanced Mathematical Methods for Finance (2005-2010);
- Methods of Integrable Systems, Geometry, Applied Mathematics (2004-2009);
- Global and geometrical aspects of nonlinear partial differential equations (2004-2009).

According to the ESF guide-lines, the "Research Networking Programmes are "open" activities. Principal participants within a Programme, e.g. Steering Committee members, are expected to network with colleagues in other research groups to ensure that opportunities in a Programme's activities are known and are open to all eligible participants. New participants to a Programme from participating countries can be co-opted during the lifetime of the Programme upon decision of the Steering Committee".

Although ESF activities have now more than thirty years, the situation towards the Mathematical Sciences is now different and has much improved in recent years. There is no possible comparison between the current activities in Mathematics and the situation in the begin of the nineties, when one of the first five

years Scientific Programmes in this area was successfully proposed through an Iberian initiative on "Mathematical Treatment of Free Boundary Problems" and launched in January 1993, when the ESF had 54 member institutions from only 20 countries. FBPNews, the Newsletter of ESF mathematical programme was available in the web since 1994 and can still be consulted at http://newsletter.fbpnews.org/.

ESF Research Conferences

The European Science Foundation (ESF) and the European Mathematical Society (EMS), supported by the European Research Centres on Mathematics (ERCOM), have agreed to co-sponsor a series of Scientific Conferences, within the framework of the ESF Research Conferences Scheme. The conferences generally last for four or five days and up to 150 participants and invited speakers may attend. Chairs select participants from applications received as a result of publicising the conferences. A conference fee is charged to participants. The Series is known as 'ESF-EMS-ERCOM Mathematics Conferences', and aims at the highest scientific level with respect to topics and choice of participants. The Conferences intends to bring together participants and experts in mathematics to discuss topics that are of major importance to the scientific community in Europe. Conferences in the series are supposed to be hosted in and co-sponsored by selected ERCOM institutions participating in the Scheme, including CIM.

For 2010 the following ESF Mathematics Conference in partnership with EMS and ERCOM have been announced: Algebraic Methods in Dynamical Systems, Bedlewo, Poland, 16.5 - 21.5; Teichmueller Theory and Its Interactions in Mathematics and Physics, Bellaterra, Barcelona, Spain, 28.6 - 3.7.

Forward Look on Mathematics and Industry

With the purpose "to explore ways of stimulating and/or intensifying the collaboration between Mathematics and Industry" the ESF has started last April in Rome a new Forward look, that was proposed by Mario Primicerio (U. Florence) on behalf of the Applied Mathematics Committee of the EMS. This project intends to identify common issues, questions, and "good practices" between Mathematics and Industry in order to envisage strategies for a stronger interaction of mathematicians with large and medium size companies aimed at technological advancement. The project that should be completed in 2010, will build on the results of the OECD 2008 report on Mathematics and Industry (see: http://www.oecd.org/dataoecd/47/1/41019441.pdf) by focussing on the specificities of the European context.

The activity of the Forward Look, that is coordinated by the proposer and current president of the Applied Mathematics Committee of the EMS is structured in three working groups dedicated to "Training and career development", "Academia-Industry interface" and "Opportunities and challenges", that are coordinated, respectivly by Magnus Fontes (U. Lund), by Volker Mehrmann (T. U. Berlin) and Yvon Maday (U. Paris VI). More information can be found in the Forward Look website http://www.ceremade.dauphine.fr/FLMI.

Towards a European Virtual Library in Mathematics

An ESF Preparatory Meeting for exploring the creation of an European infrastructure for Mathematics, focused on digitization, access to research journals, doctoral dissertations and bibliographical databases was organised in Santiago de Compostela, Spain, 13-14th March 2009 http://www.usc.es/ esfmaths/. Following several joint activities between the European countries participating in the WDML (World Digital Mathematical Library http://www.wdml.org/) digitization project, a certain number of workshops and meetings were held in the last years, including Berlingen (2002, 2003), Gottingen (2003), Stockholm (2004), Aveiro (2006), Prague and Birmingham (2008).

Many European mathematical societies, national libraries and documentation centres have been collaborating in order to prepare digitization projects at a European level, including the so-called DML-EU initiative under the auspices of the EMS. In particular, the EMS Committee on Electronic Publishing (EPC/EMS) is keeping the Society "abreast with the development of electronic tools of doing mathematics such as electronic publishing, archiving and communication" and keeping reviews on the progress in these areas and making suggestions helping to build the appropriate electronic infrastructures. This issues involve topics such as the need for standardization and coordination, identification of intellectual property rights, the conflict of interests among stakeholders, technical standards, metadata, long term preservation and the importance of bibliographical databases, such as, Zentralblatt MATH or MathSciNet.

The Santiago de Compostela preparatory meeting, with more than thirty participants, had a programme organised under the coordination of Manuel de Léon (PESC/ESF), Pavel Exner, Thierry Bouche and Enrique Macías-Virgós, from the EPC/EMS. The workshop aimed to survey the current activities in Europe, and brief reports of national initiatives aligned with the European Virtual Library of Mathematics where presented, namely from Bulgaria, Czech Republic, France, Greece, Italy, Poland, Serbia, Spain and United Kingdom.

The conclusions of this workshop helped to prepare a European perspective on the topic and contributed to the preparation of another future collaborative initiative of the ESF with Mathematics in Europe. In particular, it is also expected that it may be useful to the EMS that is facing the challenge of the new FP7 opportunity on "Infrastructures for Mathematics and its interfaces in science, technology and society at large".