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Press release

Technische Universität Berlin

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05/05/1998 http://idw-online.de/en/news2461

Research projects Mathematics, Medicine, Nutrition / healthcare / nursing, Physics / astronomy, Social studies transregional, national

Highlights: Congress of Mathematicians

Second announcement

The International Congress of Mathematicians - World Congress.

Berlin will be the centre of the mathematical world from 18th to 27th August 1998.

Dear members of the press, radio and television,

In our Press Release No. 19 (February 1998) we gave advanced announcement that this year Berlin will be the venue of the "International Congress of Mathematicians", the largest and most prestigious mathematical congress, held every four years. (If you would like to see this press release but did not receive a copy call us at Tel: +49 30 314-22919).

Of course, many of the presentations at the congress will only be comprehensible to the experts. But both the scientific programme and the popular science programme to be held in the Berlin Urania include items which will be of interest to a wider public. We have therefore drawn up a list for you of some of topics which should prove to be of interest to non-specialists.

In recent years, mathematical topics have frequently been the subject of reports in the media. The following presentations at the congress in Berlin reflect current developments in mathematical research:

Cryptology: Important for digital signatures and security for internet communications.

Wavelets: These can be used for the compression of data in order to allow rapid transmission or storage.

Chaos: There was considerable coverage of the aesthetic images a few years ago. Applications of chaos theory now cover a whole range of fields from physics through to medicine.

Optimisation: Mathematical models can be used to organise bus schedules, to manage stores and logistics, or to allocate flight crews efficiently. Millions can be saved.

Complexity: A classical example of the attempts to describe nature using mathematical models is weather forecasting. Computer simulations are also used to test new materials or to design planes which are quieter. But time and again nature proves to be more complex than expected, so that new mathematical models have to be further developed if they are to be appropriate for applications in science and technology.

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Leading scientists will give talks on the following five topics for a wider German-speaking audience.

Evolution and mathematics

The games nature plays

Does evolution require cooperation between altruistic individuals, or do exploiters and tricksters gain the upper hand as a law of nature? Game theorists have been working on this question since the late seventies. A famous tournament was initiated by Robert Axelrod for computer programs, which was won by a "tit-for-tat" strategy - cooperate when the other cooperates, retaliate if they are uncooperative. Although this strategy seemed to reflect reality well, things are usually much more complicated. Random events can disturb communication, mutations have to be taken into account, and if a population all practices tit-for-tat, they can quickly be exploited by other organisms. In a series of publications in Nature in 1992/3, Karl Sigmund from Vienna and Martin Nowak from Oxford presented improvements in the form of a Pavlov strategy. Scientific American referred to the results of Sigmund as being "at least as interesting as the computer tournament of Axelrod" (October 1993, page 12). In Germany, not much attention has yet been paid to these new developments.

Prof. Karl Sigmund (University of Vienna, Institute of Mathematics, Boltzmanngasse 9, 1090 Vienna, Austria) will be giving a plenary address to the congress. You may like to refer to the article "The arithmetics of mutual help" by Martin Nowak, Robert May and Karl Sigmund in Scientific American, June 1995 (Vol. 272 No. 6, pp. 50 - 55).

2. Our genes betray our origins In order to establish the evolutionary lineage of organisms, biologists have collected and classified external characteristics of plants and animals. However, the analysis of their genetic material can disclose hidden details of the phylogenesis, allowing far-reaching conclusions to be drawn which would otherwise have been impossible. The problem is that there is so much genetic information that it can only be evaluated using supercomputers and highly efficient algorithms. Andreas Dress from Bielefeld (together with Nobel Prize winner Manfred Eiger, Göttingen and Hans-Jürgen Bandelt, Hamburg) has developed mathematical models which can use the enormous amounts of data stored in microbiology institutes to reconstruct evolutionary trees, for example for bacteria. This has led to a surprisingly compact and productive mathematical theory which allows sequential data to be interpreted as elementary, superimposed structures (comparable to Fourier analysis which splits signals up into their periodic components). Prof. Andreas Dress will deliver a paper in the "Applied Mathematics" section of the congress (Address: University of Bielefeld, Postfach 100131, 33501 Bielefeld, Germany).

Mathematics in everyday life Popular talks at the Berlin Urania

3. The mathematics of CD players

When a laser moves over the surface of a compact disk it can be diverted by grains of dust or scratches on the surface of the CD. Errors can also arise if the laser gets out of alignment. Therefore the music on the CD is stored in such a way that it plays properly even if there are reading errors. Special mathematical coding procedures include a checking code at the end, rather like the ISBN number on a book. If this does not fit together with the preceding figures (which is checked using a simple formula) then there has been a reading or pressing error. But the CD coding system is then able to decide what the mistake is and correct it automatically. Speaker: Jacobus H. van Lindt, Technical University Bos 513, 5600 MB Eindhoven, Holland

4. Financial mathematics

Since the seventies, so-called derivatives have been traded on the world's financial markets as a sort of insurance for currency and share transactions. Customers are able to buy a guarantee from their bank that stocks will be bought or

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sold at some point in the future for a specified price, which offers protection against currency fluctuations. Using the Black-Scholes formula it is possible to calculate the price of such derivatives. Last year the discoverers were awarded the Nobel Prize for economics. In order to obtain a realistic results, efforts have been made to adapt the basic mathematical model to the complexities of the world of finance - a booming field in mathematical economics. Speaker: Walter Schachermayer, Institute of Statistics and Operations Research, University of Vienna, Bruenner Str. 72, 1210 Vienna, Austria

5. Screening for breast cancer

The ties between mathematics and medicine are closer than many people would suppose. A perfect example is computer tomography. A key aspect of this method is the mathematical procedure which makes it possible to reassemble the cross-sectional images to form a three-dimensional image. New medical applications for mathematics are being developed in the institute of Prof. Hans-Otto Peitgen in Bremen. He presents methods for computer-aided liver surgery and for the early recognition of breast cancer. Speaker: Hans-Otto Peitgen (Centrum für medizinische Diagnosesyteme und Visualisierung GmbH, Universitätsstr. 29, 28359 Bremen, Germany).

Further talks at the Berlin Urania will be looking at the cultural role of mathematics. We are particularly pleased that the author Hans-Magnus Enzensberger has agreed to come. From the world of music, Peter Hoffmann from the Xenakis Institute in Paris will be talking on the stochastic music of the architect and musician Xenakis. The director of the Institute of New Music of the Hochschule der Künste Berlin, the composer Orm Finnendahl will talk about mathematical processes in his composing, and a performance of some of his work is planned.

An exhibition of "Hands-On Mathematics" will be on show at the Berlin Urania throughout the congress. This was initiated by Prof. Albrecht Beutelspacher from Giessen, where it was already presented in March and met with enthusiastic responses from mathematicians, teachers, school pupils and journalists. Exhibits include enormous cylindrical bubbles, secret codes and a kaleidoscope that you can crawl into. Prof. Beutelspacher is planning a Museum of Mathematics in Giessen, which is intended to offer just as much enjoyment and scope for experimentation. The Urania events will also consider the position of mathematics in the media. Gero von Radow ("Die Zeit") will be considering "How does mathematics get into the paper".

Vasco Alexander Schmidt German Union of Mathematicians

At the beginning of August you will be receiving further information about the congress, with full details of the popular accompanying programme and an invitation to the press conference (Provisionally planned for 18th August - please note!)

Further information can be obtained from: Prof. Martin Grötschel, Department of Mathematics, TU Berlin and Vice-President of the Konrad Zuse Centre for Information Technology Berlin (ZIB). Tel: +49 30 84185-210, e-mail: groetschel@zib.de; or Prof. Martin Aigner, Congress Public Relations, Tel: +49 30 838-75443, e-mail: aigner@math.fu-berlin.de. Also: Dr. Kristina Zerges, Head of Public Relations, TU Berlin, Tel. +49 30 314-22919, Fax -23909, e-mail: pressestelle@tu-berlin.de

Further information about the congress is available under: http://elib.zib.de/ICM98