

Stimulating Mathematics in Industry

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70's and 80's

- Industry realized the usefulness of the mathematics community in providing new insights, understanding and useful contacts...
- Academic mathematicians discovered that industry can provide:
 - new relevant problems
 - intellectual buzz
 - stimulating collaborations
 - excitement for young researchers

70's and 80's

- What was done...

Traditional engineering applications, numerical schemes, modelling and validation.

1968 First Study Group in UK

1984 Foundation of European Consortium for Mathematics in Industry (ECMI)

1987 First International Congress for Industrial and Applied Mathematics (ICIAM)

Growth of centres - ITWM, MIRIAM, OCIAM, IMA, etc.

90's — 00's

- Explosion of activity as computers became ubiquitous and software easily available
- Emergence of low tech applications in textiles, food, leisure, etc.
- Spread of study groups - at least 10 are now held annually.
- Appearance of 'Intermediate' Institutions
 - Fraunhofer in Germany
 - Faraday in UK
 - MITACS in Canada
- Creation of Networks
 - MACSInet 2000 — 2003
 - NETIAM 2004 — 2005
- RTN's and SIGs formed to focus on particular applications.

The links between economic sectors & scientific themes (2002)

	Simulation	Multi-disciplinary design	Uncertainty and Risk	Data	Complex Systems	Market Behaviour
Aerospace & defence	✓	✓	✓	✓	✓	✓
Automotive	✓	✓	✓		✓	
Banking and finance			✓	✓	✓	✓
Food and drink	✓	✓	✓	✓	✓	
Chemical	✓		✓	✓	✓	
Construction	✓	✓	✓		✓	
Retail & distribution			✓	✓	✓	✓
Energy & utilities	✓		✓	✓	✓	✓
Electronics & Hardware	✓				✓	
Pharmaceuticals	✓	✓	✓	✓	✓	✓
Medicine	✓	✓	✓	✓	✓	✓
Textiles	✓					
IT and software				✓	✓	
Leisure & entertainment	✓		✓	✓		
Mining	✓		✓	✓		
Telecommunications	✓	✓	✓	✓	✓	✓
Transport	✓	✓	✓	✓	✓	✓
Paper and forestry	✓		✓			
Crime detection			✓	✓		



New and Emerging Themes in Industrial and Applied Mathematics

- NETIAM is supported under the NEST (New and Emerging Science and Technology) programme of framework 6
- NETIAM aims to
 - demonstrate how mathematics can be used in the formulation of **unexplored multidisciplinary** research challenges
 - increase awareness of this role across a wide range of research disciplines, end-users in industry, business and government
 - develop mechanisms for strengthening and developing multidisciplinary collaborations

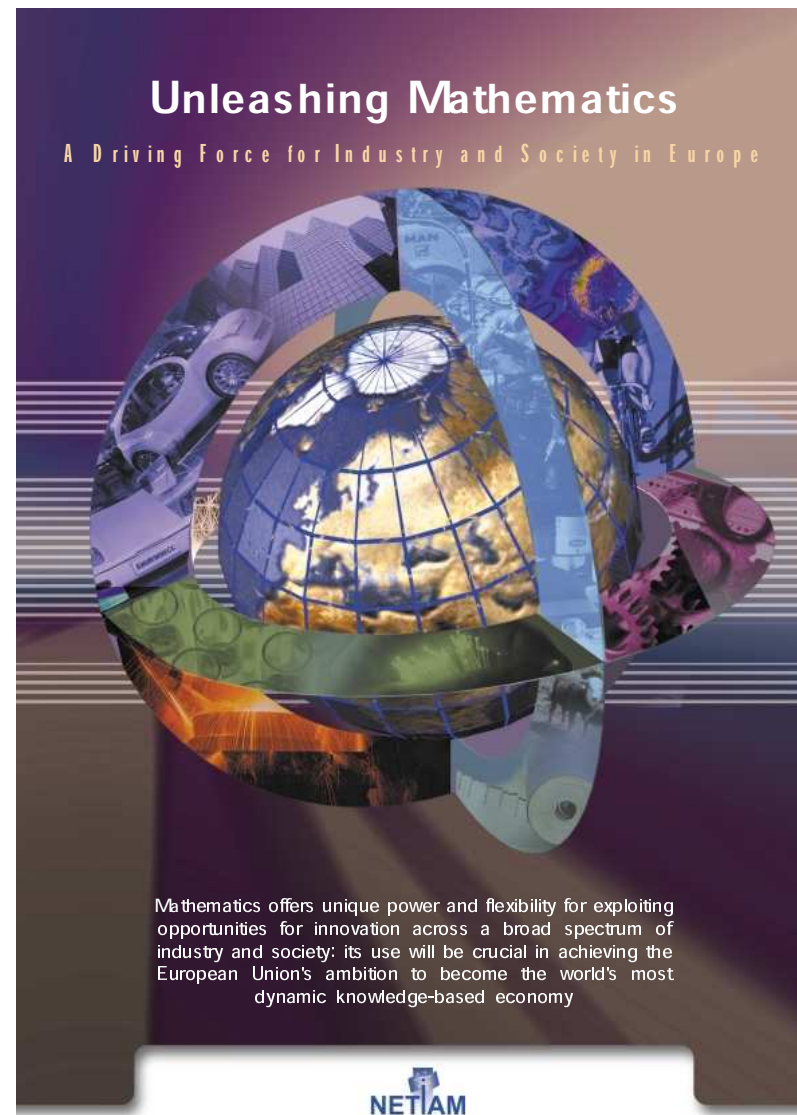
Thematic workshops were held on:

- criminality in the urban environment
- modelling the business environment
- visualisation, simulation and design for virtual porous materials
- complexity in modelling at the molecular level

A **capstone meeting** identified three underpinning methodologies:

- modelling over disparate time and length scales
- dynamic network modelling
- visualisation and computational geometry

A **strategy meeting** of leading figures from the mathematics community was held in July. The results of this meeting are described in the leaflet '**Unleashing Mathematics**'.



Unleashing Mathematics is a strategic initiative to help deploy the power and flexibility of mathematics across a broad spectrum of applications.

Initially a team will be set up to:

- raise awareness and use of mathematics
- identify the best way to co-ordinate interdisciplinary mathematics
- construct an Action Plan for Mathematics in Industry and Society to start in 2007.

If you would like to know more please see:

www.smithinst.ac.uk/Projects/NETIAM/UnleashingMathematics

or contact: office@smithinst.co.uk

2005 - Maths is being applied more and more widely
e.g. medicine, crime, policy making, management, entertainment

More and more maths is being applied

e.g. discrete maths, geometry, stochastic analysis, data mining

MODELLING SKILLS ARE VITAL

This means there is a need for:

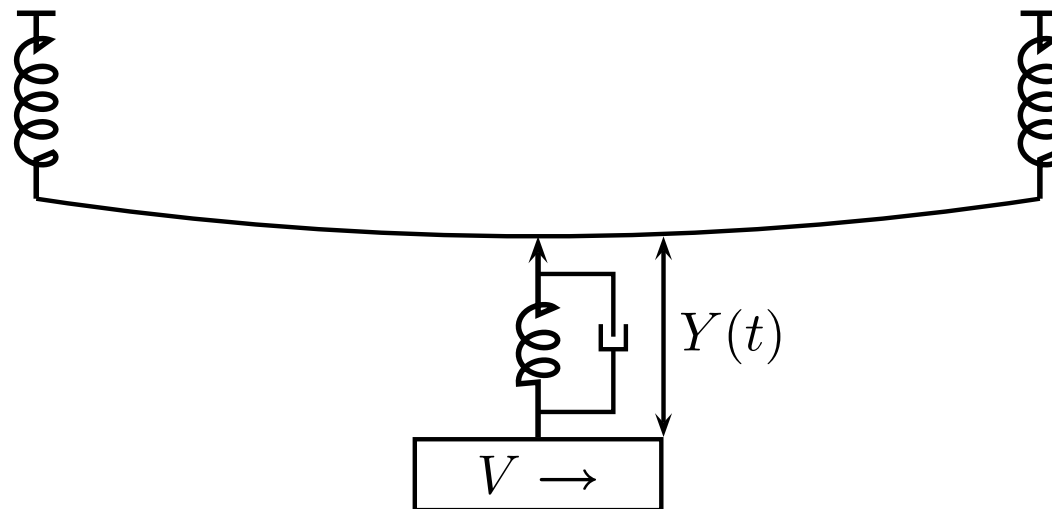
- coordination, collaboration and management to prevent duplication and allow efficient access to both expertise and problems.
- more training for mathematicians to work in interdisciplinary fields.

**WE MUST WORK TOGETHER TO EXPLOIT OUR
FULL POTENTIAL**

Pantograph problem



Problem: Model and redesign overhead electricity collection system for a train to ensure contact is maintained throughout.



A simple spring and dashpot model leads to a functional/differential equation for Y :

$$\frac{dY}{dt} = k(Y(\mu t) - Y(t))$$

where $\mu = (c - u)/(c + u)$ and c is the speed of sound in the wire.

The model helped in design of the pantograph but also led to a lot of theoretical work on a generalised version of this equation which is now known as the **Pantograph Equation**.

A colouring problem in 3D

(BAe systems 2004)



Problem: An office block consists of n floors each made up of cuboid offices of varied size.

Each office has its own radio frequency which must, for security reasons, be different from the frequency of all neighbouring offices - up, down and sideways.

How many different frequencies are needed?