

$PA_1 = PD,$
 $PD = \sin\left(\frac{\pi}{n}\right)\cos\left(\frac{\pi}{n}\right),$
 $r_n = n \sin\left(\frac{\pi}{n}\right)\cos\left(\frac{\pi}{n}\right) \dots\dots\dots(1)$
 Next, consider the regular n -sided polygon B_1, B_2, \dots, B_n circumscribing the circle of radius 1 with centre at P . Let PE be perpendicular from P on B_1B_2 . Then,
 $PE = 1$ and $\angle B_2PE = \frac{\pi}{n}, \tan\left(\frac{\pi}{n}\right) = \frac{B_2E}{PE} = B_2E.$
 So the area of $\Delta B_1B_2P = PE \cdot B_2E = \tan\left(\frac{\pi}{n}\right)$. Hence, $O_n = n \tan\left(\frac{\pi}{n}\right) \dots\dots(2)$
 Now, $\frac{2J_n}{O_n} = 2 \cos^2\left(\frac{\pi}{n}\right) \dots\dots\dots(3)$
 We have $1 + \sqrt{1 - \frac{4J_n^2}{n^2}} = 1 + \sqrt{1 - 4 \sin^2\left(\frac{\pi}{n}\right)\cos^2\left(\frac{\pi}{n}\right)} = 1 + \cos\left(\frac{2\pi}{n}\right) = 2 \cos^2\left(\frac{\pi}{n}\right) \dots\dots(4)$
 (3) and (4) prove the result.

NETIAM
NEST SUPPORT

NETIAM is giving mathematicians the opportunity to contribute their expertise at a much earlier stage in the research process.

The NETIAM project is developing mathematics as a tool to integrate the approaches of science from many disciplines. New theoretical and computing techniques, and collaborative formulation of unexplored research challenges, enable maths to play a vital part in the research process much earlier than previously. The project will link multidisciplinary teams on four very complex problems of sociology, economics, manufacturing and natural sciences. The new common mathematical approaches derived should apply to many other issues, and generate new ADVENTURE and PATHFINDER projects.

Maths is the common denominator

Until now, mathematics has mainly been used for analysis, and for devising quantitative system models. Now the NETIAM project under NEST is giving mathematicians the opportunity to contribute their expertise at a much earlier stage in the research process. Working in each of four complex research areas, mathematical theories of multiscale phenomena, complexity, risk and uncertainty will be used to tackle four broad, complex themes. It is expected that broader principles will then emerge for building maths approaches more generally into the fundamental framework of research initiatives. NETIAM is a NEST support action, so it should contribute to the development of other future NEST projects.

Four key themes

NETIAM has five participating organisations, from five EU Member States. They will hold thematic workshops on the following areas:

- Modelling criminality in the social environment
- Challenges in modelling the business environment

- Challenges in visualisation and simulation for virtual materials analysis and design
- Complexity at the molecular level.

The themes have been identified by the partners as showing particular emerging opportunities for novel mathematics. They provide an opportunity to demonstrate how mathematics provides a common language with which to approach interdisciplinary research. The criminality study will explore the construction of models of collective behaviour, and develop tools for understanding and predicting large-volume crime and organised crime, ultimately working towards control methods. Maths in the business environment means advanced modelling for financial risk management – vital for future economic competitiveness. Developments here may lead to future NEST PATHFINDER initiatives.

Virtual materials analysis and design have recently been opened up by advances in 3D-imaging, computer speed and the sheer size of available memory. They have endless applications in industry, based



NETIAM NEST SUPPORT

Modelling criminality in the social environment is just one theme of the workshops that will be held by the NETIAM project.

AT A GLANCE

Official title

New and emerging themes in industrial and applied mathematics

Coordinator

United Kingdom: Smith Institute

Partners

- *Germany: Fraunhofer-Institut für Techno- und Wirtschaftsmathematik*
- *Italy: Università degli Studi di Firenze*
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on new applications in stochastic and differential geometry, theory and numerics of partial differential equations, optimisation and control theory. These advances could lead to improved product quality, significant reductions in manufacturing and testing costs, and production lead times, and better use of energy and raw materials. The fourth area concerns a broad range of research subjects in biological and materials sciences where mathematical modelling is required. Molecular-level events are responsible for key functions like the targeting of drugs towards particular body tissues, so the workshop will address the geometry of such events, in terms of quantum mechanical calculations and new ways to model atomic and gene activity.

Ideas beget ideas

During the planning, each theme will be considered in relation to the others, to facilitate cross-fertilisation of ideas and determine where similar mathematical challenges arise in different contexts. This open, multidisciplinary approach should enable generation of potential NEST ADVENTURE projects.

Up to 20 experts, including mathematicians, other researchers, and end-users in industry, business and government will be invited to each thematic workshop. The operation will be facilitated by staff experienced in brainstorming with multidisciplinary groups. Their aim will be to ensure a balance between strategy and detail, and a mix of scientific 'push' and application 'pull'. The workshop reports on the new opportunities for mathematical research in each area will be disseminated widely to raise awareness of NEST, including through the project

This is an opportunity to show how mathematics provides a common language with which to approach interdisciplinary research.

partners' existing networks, including ECMI (the European Consortium for Mathematics in Industry), MACSInet (Mathematics, Computing and Simulation for Industry), the Fraunhofer Gesellschaft in Germany, and the UK's Faraday Partnership for Industrial Mathematics.

Finally a plenary workshop, arranged by the project coordinator, will then pull together the outcomes of the four work areas, and intends to integrate and develop further their ideas, hopefully to generate future PATHFINDER initiatives.



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SIXTH FRAMEWORK PROGRAMME