

Mario Primicerio:

Mathematician, Visionary and Builder of European Industrial Mathematics

*Mario helped shape the European landscape
of industrial mathematics more than
anyone else of his generation.*

π MATHEMATICS

INDUSTRY

CONNECTIONS

INNOVATION

EUROPE

Mario and ECMI

Building the European Industrial Mathematics Community

Mario's early engagement in ECMI laid the foundation for European cooperation in industrial mathematics.

ECMI

European Consortium for
Mathematics in Industry



INDUSTRY

Addressing real challenges and driving innovation



UNIVERSITIES

Mathematics expertise and scientific excellence



COLLABORATION

Connecting people, ideas and organisations across Europe



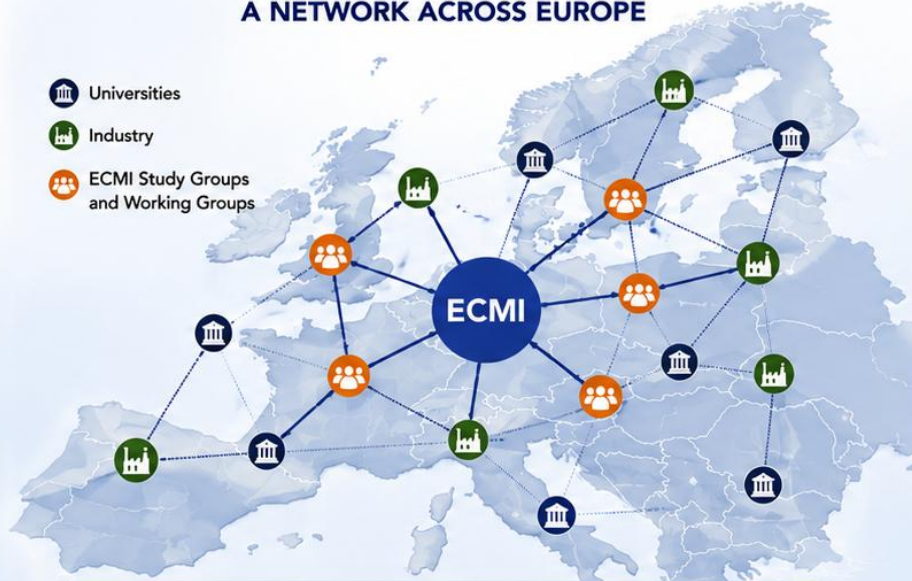
EDUCATION

Developing skills and careers for the future

ECMI: a unique platform where academia and industry meet through mathematics.

A NETWORK ACROSS EUROPE

-  Universities
-  Industry
-  ECMI Study Groups and Working Groups



Study Groups and Activities

Numerical Mathematics • Mechanical Engineering • Optimization • Education
Fluid Dynamics • Industry–Academia Interaction • and many more

MARIO'S ROLE IN ECMI



STRONG ADVOCATE

A passionate advocate for the importance of industrial and applied mathematics.



BUILDER OF COLLABORATIONS

Actively fostered links between mathematicians, engineers and industry across Europe.



ACTIVE PARTICIPANT

Deeply involved in ECMI study groups, workshops and strategic discussions.



BRIDGE BETWEEN ECMI AND EMS

Played a key role in strengthening the dialogue and cooperation between ECMI and EMS.



TOWARDS THE FUTURE

One of the driving forces behind the creation of EU-MATHS-IN, uniting European initiatives.



My first encounters with Mario were through ECMI meetings, where I discovered both his scientific depth and his passion for building European cooperation.



ECMI was where Mario helped shape a European community around industrial mathematics.

My Personal Encounters with Mario Primicerio

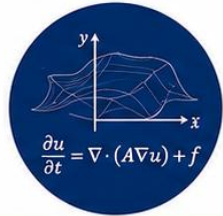
A mathematician, a leader, a visionary, a friend

“ *Mathematics provides a universal framework for innovation.*
— Mario Primicerio, Rome 2009 ”

My journey with Mario has spanned more than 2 decades, across four key milestones that shaped the future of industrial mathematics in Europe and beyond.

1 Mario as a Mathematician

How I first came to know him



- I first met Mario through his outstanding work as a mathematician.
- His expertise in applied analysis, PDEs and mathematical modelling, his rigor, clarity and depth of thought commanded immediate respect.
- Behind his excellence was always a deep curiosity and a remarkable openness to new ideas and applications.

2 Working Together in the EMS – ESF Forward Look

A shared vision takes shape



- We began intensive collaboration in the EMS Applied Mathematics Committee (AMC) and in the ESF Forward Look on Mathematics and Industry (2009–2010).
- Mario's energy, strategic thinking and ability to bring people together across disciplines and sectors were extraordinary.
- He was not just analysing the landscape – he was building a European vision for the future of industrial mathematics.

3 Building the Future with EU-MATHS-IN

From vision to lasting impact



- Our collaboration continued in the foundation of EU-MATHS-IN (2013).
- Together with many colleagues, Mario helped create the first European network dedicated to mathematics for innovation.
- He led with generosity and determination, laying the foundations for a community that today connects hundreds of organisations across Europe and beyond.

4 A Global Dimension: ICIAM and Beyond

Extending the reach of industrial mathematics



- I also worked closely with Mario in the lead-up to and during ICIAM 2011 in Vancouver.
- He was a driving force in ensuring that industrial and applied mathematics had a strong and visible presence on the global ICIAM stage.
- His international outreach and leadership amplified the voice of our community far beyond Europe.

Throughout all these years, what I admired most about Mario:



A visionary who saw opportunities where others saw obstacles.



A bridge builder who connected people, ideas and communities.



A strategist who turned ideas into concrete actions.



A generous mentor and friend, always ready to listen and encourage.



A deep believer in the power of mathematics to improve industry and society.

“ Mario's legacy lives on in all of us and in the European and global communities he helped to build and inspire. ”

Thank you, Mario, for your friendship, your leadership and for believing in the power of mathematics to make a difference.

Mario the Applied Mathematician

Mathematics in Service of Society

SCIENTIFIC CONTRIBUTIONS

Internationally recognised researcher in applied mathematics and mathematical modelling.



Heat Transfer

Mathematical models for heat conduction and convection.



Phase Transitions

Modelling solidification, melting and phase change phenomena.



Free Boundary Problems

Analysis and numerical methods for moving interfaces.



Mathematical Modelling

From PDEs to complex multi-physics models for real-world systems.

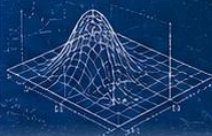
Mario did not separate mathematics from reality.

He viewed mathematics as a tool to **understand, explain and improve** the world around us.

MATHEMATICS

PDEs
Analysis
Algorithms
Models
Abstraction

$$\frac{\partial u}{\partial t} - \nabla \cdot (k \nabla u) = f$$
$$u = 0 \quad \text{on } \Gamma(t)$$
$$V_n = G(u, \nabla u)$$



APPLICATIONS

Industry
Society
Policy
Innovation
Decision Making

Mathematics is the bridge between ideas and real-world impact.

BEYOND TRADITIONAL APPLICATIONS

Mario believed that mathematics could help understand not only physical systems, but also societal challenges.



Mathematics and Crime

Using mathematical models and data analysis to understand crime, risk and prevention.



Society

Addressing challenges in health, environment, mobility and urban systems.



Decision Making

Providing quantitative insights to support better decisions in policy and management.



Understanding Complex Systems

Bringing clarity to complex phenomena through models, data and computation.

“ *Mathematics provides a universal framework for innovation.*

— *Mario Primicerio* — ”



Curiosity. Rigor. Impact.

These values guided Mario throughout his life and work.

Mathematical Models for Social Dynamics and Criminology

Mario Primicerio – Eindhoven Mathematics Spring Festival, May 9, 2011

THE PROBLEM

How can mathematics help understand criminal behaviour?

- Predict how social and economic factors affect criminality (urban community scale).
- Understand the diffusion and development of criminal behaviour in space and time.
- Frame the main socio-economic mechanisms in mathematical models for policy evaluation.

DATA: MAJOR DIFFICULTIES

- Too aggregated (mostly at country level)
- Systematic biases (under-reporting)
- No agreement on classification of crimes
- Difficult to obtain
- Difficult to disentangle causes from effects

GOAL OF MODELLING

- Not exact prediction of crime numbers, but:
 - identify mechanisms
 - compare strategies
 - optimise use of resources
 - support policy decisions

MARIO'S MATHEMATICAL APPROACH

1. GAME-THEORETIC MODELS



Evaluate costs and benefits of crime for each "player".

Nash equilibria:

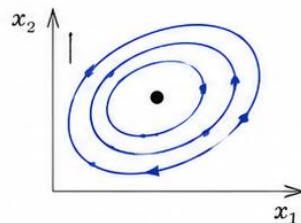
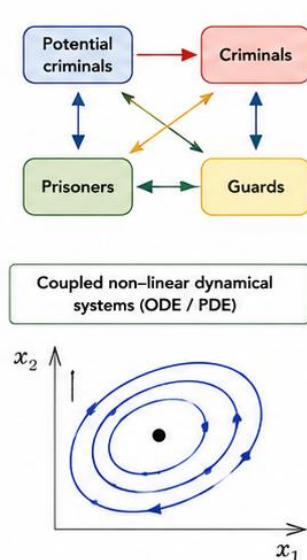
- how many offenses to permit?
- how many offenders unpunished?

Minimise social loss = harm from offenses + cost of deterrence (apprehension, conviction)

2. AGENT-BASED MODELS



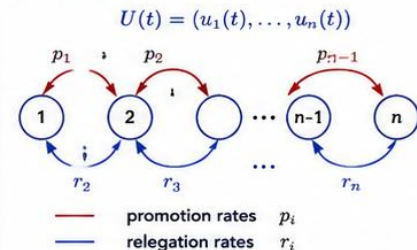
3. POPULATION DYNAMICS MODELS



SOCIAL DYNAMICS MODEL (EXAMPLE)

Population divided into n social classes.

State variables:



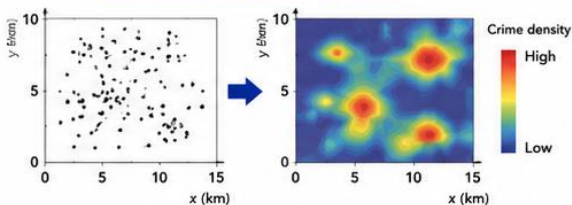
Key ingredients:

- Wealth distribution and social mobility
- Crime recruitment
- Law enforcement (arrests, convictions)
- Public expenditure (education, welfare, policing)

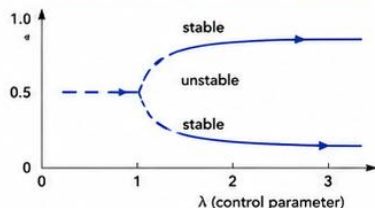
Leads to systems of differential and integro-differential equations, e.g.

$$\dot{u}_i(t) = \sum_j (p_{ji}(t)u_j(t) - p_{ij}(t)u_i(t)) - r_i(t)u_i(t) + S_i(t), \quad i = 1, \dots, n$$

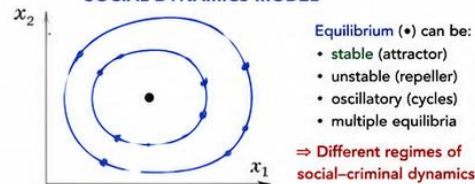
CRIME MAPPING AS ANTICIPATION



BIFURCATION IN A SIMPLE CRIME MODEL



PHASE PORTRAIT OF SOCIAL DYNAMICS MODEL



- Equilibrium (\bullet) can be:
- stable (attractor)
 - unstable (repeller)
 - oscillatory (cycles)
 - multiple equilibria
- \Rightarrow Different regimes of social-criminal dynamics

TAKE-HOME MESSAGE

Mathematical models help to understand mechanisms of criminal behaviour, to evaluate intervention strategies and to allocate limited resources in the most effective way.

Building a Strong Voice for Applied Mathematics in Europe

Mario Primicerio and the EMS Applied Mathematics Committee (AMC)



Mario Primicerio
Chair of the EMS
Applied Mathematics
Committee (2006–2012)

A Visionary Leadership within EMS

- ▶ When Mario became **Chair of the Applied Mathematics Committee (AMC)** in 2006, applied mathematics had **limited visibility and influence** within the EMS, which was largely focused on fundamental mathematics.
- ▶ Mario was convinced that applied mathematics is essential for **innovation, industry and society** and deserves a **strong and independent voice**.
- ▶ Under his leadership, the AMC became a European platform **uniting mathematicians** from academia, industry and public institutions to promote and advance applied mathematics.
- ▶ He created **bridges** between communities, built international **collaborations** and opened the EMS to new **challenges** and **societal needs**.

“

Mathematics provides a universal framework for innovation. — Mario Primicerio, Rome 2009

”

Through vision and persistence, Mario Primicerio gave applied mathematics the voice it deserved in Europe.

From Committee to European Vision

The ESF Forward Look on Mathematics and Industry (2009–2010)

The AMC as a catalyst for change



Mario Primicerio
Coordinator of the Forward Look



Three Working Groups – One Common Goal

Comprehensive analysis and concrete recommendations

-  **1. Training & Careers**
Chair: Magnus Fontes
Education, skills, training pathways and careers in industrial mathematics.
-  **2. Academia–Industry Interface**
Chair: Volker Mehrmann
Collaboration, knowledge transfer, partnerships and good practices.
-  **3. Opportunities & Challenges**
Chair: Yvon Maday
Grand challenges, emerging areas and future opportunities.

A European Journey
2009 – 2010



Rome
Kick-off Meeting
April 2009



Strasbourg
Working Meeting
October 2009



Madrid
Working Meeting
February 2010



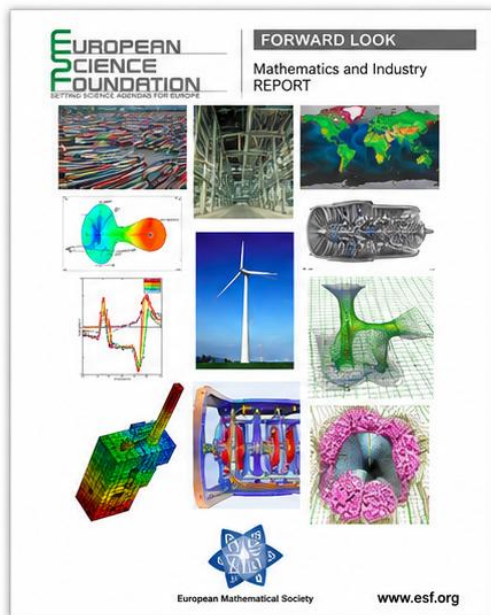
Brussels
Final Conference
June 2010

A shared vision
for the future of
industrial mathematics
in Europe

Thanks to Mario Primicerio's leadership, the ESF Forward Look laid the foundation for a stronger, more visible and more impactful role of mathematics in innovation, industry and society.

6 From Vision to Impact: The Outcome of the Forward Look

A Strategic Roadmap for Mathematics and Industry in Europe



Forward Look on Mathematics and Industry
EMS – ESF (2009–2010)

Coordinated by Mario Primicerio

THREE STRATEGIC RECOMMENDATIONS

- 

1. Build a European Institute of Mathematics for Innovation (EIMI)

 - coordinate expertise
 - create clusters of excellence
 - provide a one-stop shop for industry
- 

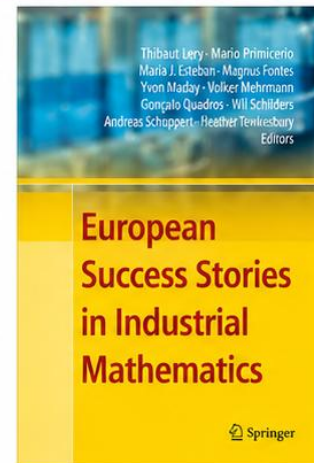
2. Overcome fragmentation

 - European networks
 - digital infrastructure
 - mobility between academia and industry
- 

3. Create common education and career paths

 - European curriculum
 - industrial mathematics engineers
 - recognition of industrial mathematics careers

“ *European Mathematics has the potential to be an important economic resource for European industry.* ”



European Success Stories in Industrial Mathematics

Edited by:

Mario Primicerio, Maria Esteban, Magnus Fontes, Yvon Maday, Volker Mehrmann, Gonçalo Quadros, Wil Schilders, Andreas Schuppert, Heather Tewkesbury, Thibaut Lery.

More than 100 examples demonstrating that mathematics drives innovation across industry and society.



Brussels, December 2010
Final Conference

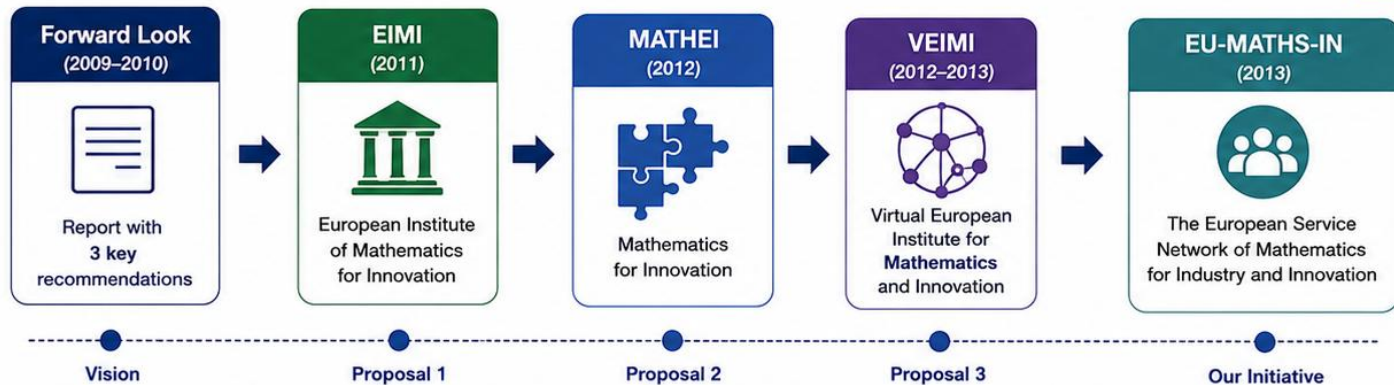
Forward Look Report
presented to European policymakers and stakeholders

From Recommendations to Action

The Road Towards EU-MATHS-IN

*The Forward Look provided a clear vision. Implementing it proved much harder.
Mario Primicerio was the driving force behind turning the vision into reality.*

“
*We have had a good idea.
Now we have to prove it.*
— Mario Primicerio
Amsterdam, November 2013
”



OUR APPROACH

-  Several proposals were developed to implement the Forward Look recommendations.
-  EIMI, MATHEI and VEIMI were submitted to the EU. **None obtained funding.**
-  Yet the community persisted, motivated by a shared vision.
-  Mario proposed a different approach: if Europe does not fund the organisation, **let us create it ourselves.**

OUR GOAL:

To create a European infrastructure that connects **mathematical excellence with innovation, industry and societal challenges.**

OUR DRIVERS:

- ✓ The needs of industry and society
- ✓ The strength of European mathematics
- ✓ A belief in collaboration and impact

 *The Forward Look did not disappear into a drawer.
It inspired a **determined community** to turn recommendations into action — and create EU-MATHS-IN.*

Founding EU-MATHS-IN

From a Vision to a Lasting European Organisation



Amsterdam Kick-off Meeting

27 November 2013



Centrum Wiskunde & Informatica

Hosted by

Centrum Wiskunde & Informatica
Amsterdam, The Netherlands



Mathematicians from across Europe came together with a common purpose:

to strengthen the role of mathematics in industry, innovation and society.



Initial Board of EU-MATHS-IN



Mario Primicerio,
Chairman



Volker Mehrmann,
Secretary



Wil Schilders,
Treasurer



Maria Esteban
(EMS)



Magnus Fontes
(ECMI)



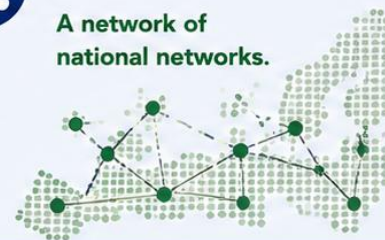
MISSION

EU-MATHS-IN aims to leverage the impact of mathematics on **innovations** in key technologies by enhanced communication and information exchange between and among the involved stakeholders on a **European level.**



UNIQUE FEATURE

A network of national networks.



Born on 26 November 2013

A European Service Network of Mathematics for Industry and Innovation

With the support of:

- European Mathematical Society (EMS) via its Applied Mathematics Committee
- European Consortium for Mathematics in Industry (ECMI)



Mathematics as a Key Enabling Technology

Driving Innovation, Competitiveness and Society

“

Mathematics provides the models, methods and algorithms that turn data and ideas into innovation and value.

A key enabling technology for Europe's future.

”

MATHEMATICS DRIVES INNOVATION IN MANY SECTORS



HEALTH & LIFE SCIENCES

Modelling diseases, optimising therapies, personalised medicine



ENVIRONMENT & CLIMATE

Climate modelling, risk assessment, resource management



MANUFACTURING & INDUSTRY

Design, simulation, optimisation, process control



MOBILITY & TRANSPORT

Traffic flow, logistics, autonomous systems, safety and reliability



DIGITAL & CYBERSECURITY

Cryptography, data analytics, secure communication



FINANCE & INSURANCE

Risk analysis, quantitative finance, fraud detection



SOCIETY & POLICY

Decision support, forecasting, policy evaluation

FROM RESEARCH TO IMPACT



Understand
Mathematical research reveals structure, patterns and laws.



Model
Mathematics builds models that capture reality.



Compute
Algorithms and computation turn models into results.



Innovate
Insights enable better products, services and processes.



Impact
Economic growth, societal benefit, better lives.



WHY IT MATTERS

- ✓ Boosts innovation across all sectors
- ✓ Increases productivity and efficiency
- ✓ Supports sustainable solutions
- ✓ Strengthens Europe's global competitiveness
- ✓ Improves quality of life and societal well-being

THE POWER OF MATHEMATICS



Connects theory with real-world challenges
Mathematics translates complex problems into solvable models.



Enables data-informed decisions
From data to insight to impact.



Drives digital transformation
From algorithms to artificial intelligence and digital twins.



Supports sustainability
Mathematics helps us understand, predict and act for a better future.



Mario Primicerio's vision was clear:

Place mathematics at the heart of innovation in Europe.

EU-MATHS-IN was created to make this vision a reality.

LOOKING FORWARD

EU-MATHS-IN continues to champion mathematics as a key enabling technology for Europe's innovative, sustainable and resilient future.

“

When mathematics and innovation work together, Europe prospers.

”

Passing the Torch

From Founder to Successor

Rome, December 2015

Rome, December 2015
EU-MATHS-IN Council Meeting



European Service Network
of Mathematics for Industry
and Innovation

Mario Primicerio
Founding President
2013 – 2015



Wil Schilders
President
2016 – ...

UNDER MARIO'S LEADERSHIP (2013–2015)



Forward Look

Positioning mathematics for innovation



Success Stories

Showcasing the impact of mathematics



EIMI / MATHEI / VEIMI

European proposals for a math-for-innovation infrastructure



EU-MATHS-IN

Creation of a network of national networks across Europe



Mathematics as a Key Enabling Technology

Advocating mathematics in policy and innovation



Birth of the MSO Initiative

Mathematical Modelling, Simulation and Optimisation



A PERSONAL RECOLLECTION

Before the Council meeting, Mario, Maria Esteban and I were sitting together in Rome. Mario announced that he intended to step down as President of EU-MATHS-IN. When I asked who should succeed him, both Mario and Maria immediately pointed at me. It was a simple gesture, but one I have never forgotten.

“ Great leaders do not only build organisations. They ensure that others are ready to continue the journey. ”

Mario Primicerio on the World Stage

Connecting Europe to the Global Applied Mathematics Community



ROOTED IN EUROPE



EUROPEAN
MATHEMATICAL
SOCIETY

Applied Mathematics
Committee (AMC)
leader and visionary

ECMI

EUROPEAN CONSORTIUM FOR
MATHEMATICS IN INDUSTRY

Strengthening links
between mathematics
and industry



Founder and
first President
(2013–2015)



Building a strong European ecosystem
for industrial and applied mathematics
and promoting mathematics as a
Key Enabling Technology.

From Europe to the World – and back



Mario believed that industrial mathematics
should be a **global endeavour**,
benefiting all regions and all communities.

MARIO'S ROLE WITH ICIAM



ICIAM

International Council for Industrial
and Applied Mathematics



OFFICER-AT-LARGE

Serving the ICIAM Executive Committee
and the international community.



MEMBERSHIP COMMITTEE MEMBER

Supporting the growth and engagement
of members worldwide.



GLOBAL AMBASSADOR

Bringing the European experience to ICIAM
and learning from communities around the world.



SUPPORTING DEVELOPING COUNTRIES

Advocating for the growth of industrial and
applied mathematics in all regions.



BRIDGING COMMUNITIES

Connecting mathematicians, institutions and
industries across the globe.



Mario was one of those rare people
who could move effortlessly between
local, European and global levels.

“ *Strong national communities,
strong European structures and a strong international community
reinforce each other.* ”



**ONE VISION.
MANY CONNECTIONS.
GLOBAL IMPACT.**
That was Mario.

Mario Primicerio's Lasting Legacy

A Visionary. A Builder. A Mentor. A Friend.

MARIO WAS...



A VISIONARY

He saw early the power of mathematics to drive innovation and societal progress.



A BUILDER

He built communities, networks and organisations that continue to thrive.



A MENTOR

He trusted people, gave them responsibility and empowered them to lead.



A FRIEND

Warm, generous and always ready to listen, encourage and support.



AN INSPIRATION

His enthusiasm, integrity and dedication inspired so many across generations.

“ *He did not seek recognition. He sought impact.* ”

Mario connected people, ideas and organisations to create a lasting impact for mathematics, innovation and society.



STRONG
NATIONAL
COMMUNITIES



EUROPEAN
COLLABORATION



GLOBAL
CONNECTIONS



INNOVATION
FOR SOCIETY



He built bridges that continue to carry us forward.

AN ENDURING IMPACT



FORWARD LOOK

A milestone report that set the direction.



EU-MATHS-IN

A network that unites Europe.



MATHEMATICS AS A KEY ENABLING TECHNOLOGY

A message that changed perceptions.



ICIAM AND GLOBAL IMPACT

Bringing Europe's voice to the world.



MSO → MSODE

A vision that anticipates today's challenges.



PEOPLE AND FRIENDSHIPS

A legacy in the hearts of all who knew him.

HIS LEGACY LIVES ON



INSTITUTIONS

Strong organisations continue to grow and make a difference.



COMMUNITIES

A connected community of mathematicians, industry and innovators.



NEXT GENERATIONS

Young leaders inspired and empowered to take the baton forward.



SOCIETY

Better solutions, better technologies, better lives.



HIS SPIRIT

Curiosity, passion, integrity and kindness remain a guiding light.

“ *The best tribute to Mario is to continue building the future he believed in.* ”



“

The future is not something we enter. The future is something we build.

THANK YOU, MARIO.

Your legacy inspires us to keep building.

”



Grazie, Mario.

You will always be with us.

$$\partial_t u - \nabla \cdot (k \nabla u) = f$$

$$y_t = \mathcal{N}(y_{t-1}, \theta)$$

$$\min_{u \in U} J(u)$$

$$\frac{d}{dt} E(t) \leq 0$$

$$y = \mathcal{M}(x; \theta)$$

$$\frac{\partial L}{\partial \theta}$$

Grazie, Mario.

*The bridges you built
continue to carry us forward.*



Scientist



Teacher



Mayor



European Leader



Friend

Thank you, Mario, for building bridges between mathematics, industry and society.

