

Foreword

The History of the Mechatronics Forum

Memiş Acar¹

Origins

The Mechatronics Forum came into existence at a meeting held at the Institution of Mechanical Engineer's (IMechE) London headquarters on the 30th of October, 1990, and was attended by over 70 individuals. The Forum was the first organisation in the Western world to recognise the importance of mechatronics and to promote it as an integrating engineering discipline.

Although the word Mechatronics has been around since 1969 – the term was coined by Mr. Tetsuro Mori, a senior engineer of the Japanese company Yaskawa – it was only in the early 1990s that it began to be used to any great extent in the UK. However since then, through the activities of the Mechatronics Forum, the term mechatronics and the engineering design philosophy that it encompasses has become widely recognised.

Mechatronics today extends beyond the integration of mechanical, electronic and computer engineering. Many engineers now see it as embracing a wider range of engineering activities, from design through manufacture to the market place. Hence, they regard mechatronics as a major influence in pulling together and integrating the many aspects of engineering which increased specialisation has tended to push apart over recent years.

It was in an attempt to solve this increasingly difficult problem that the Mechatronics Forum was conceived as a first step towards the building of bridges between the many technologies, philosophies and disciplines which comprise mechatronics and the professional institutions that are committed to their own particular specialised subjects.

In this context, the Mechatronics Forum initially operated under a series of inter-institutional arrangements, with secretarial and administrative services provided alternately by the Institution of Mechanical Engineers (IMechE) and the Institution of Electrical Engineers² (IEE). However, in recent years, this

¹ Loughborough University, UK

² Now the Institution of Engineering and Technology (IET)

relationship has changed on a number of occasions and it currently operates under the auspices of the IMechE.

Mechatronics Forum Committee and Its Chairs

The founding Committee of the Mechatronics Forum was charged with a comprehensive portfolio of objectives including setting up and establishing a publication of a regular Newsletter, popularising mechatronics, focusing on educational issues, and seeking ways of bringing together all those interested in mechatronics, and especially of promoting closer links between industry and academia. These are still the objectives today, and significant advances have been made in relation to a number of them.

Today, the committee includes a number of members from outside the UK who help with the internationalisation of the Mechatronics Forum and its activities. To this end, the majority of its international biennial conferences have been held outside the UK.

The first Chair of the Mechatronics Forum was Professor Jack Dinsdale of the University of Dundee; the complete list of Chairs to the time of writing is:

1990	Professor Jack Dinsdale	University of Dundee
1993	Professor Jim Hewit	Loughborough University
1994	Professor Rob Parkin	De Montfort University
1995	Professor Tim King	The University of Birmingham
1996	Professor Phil Moore	De Montfort University
1997	Dr Memis Acar	Loughborough University
1998	Dr Klaus Selke	University of Hull
2000	Dr Memis Acar	Loughborough University
2004	Professor Geoff Roberts	Coventry University
2008	Professor Phil Moore	De Montfort University

Mechatronics Forum Conferences

The Mechatronics Forum was the first professional group to organise conferences on this engineering field. The first conference was organised at Lancaster University in 1989 by Dr David Bradley³ who was, along with Prof. Jack Dinsdale and Prof. Jim Hewit, one of the three leading founders of the Mechatronics Forum. Although the Mechatronics Forum did not exist then as an organisation, the concept was in the minds of its founders at the time of the Lancaster conference. Hence, it is proper to count this conference as the first of the Mechatronics Forum Conferences.

This first conference was followed by conferences in Cambridge (1990) and Dundee (1992). After holding the first three conferences in the UK, in 1994 the Mechatronics Forum held its first conference outside the UK, organised in

³ Now Prof. David Bradley and one of the editors of this book

collaboration with the Technical University of Budapest, Hungary. With this initiative, Prof. Jim Hewit played a pivotal role in the internationalisation of the Mechatronics Forum Conferences. All subsequent conferences have been held outside the UK. The following is the complete list of the biennial Mechatronics Forum Conferences to the time of writing:

1989	1st Conference ⁴	<i>Mechatronics in Products and manufacturing</i> Lancaster University
1990	2nd Conference ³	<i>Mechatronics – Designing Intelligent Machines</i> IMechE conference at Robinson College, Cambridge
1992	3rd Conference	<i>Mechatronics – The Integration of Engineering Design</i> University of Dundee, Dundee, Scotland
1994	4th Conference	<i>Mechatronics: the Basis for New Industrial Development</i> Technical University of Budapest, Budapest, Hungary
1996	5th Conference	University of Minho, Minho, Portugal
1998	6th Conference	University of Skövde, Skövde, Sweden
2000	7th Conference	Georgia Institute of Technology, Atlanta, USA
2002	8th Conference	University of Twente, Twente, The Netherlands
2004	9th Conference	Middle East Technical University, Ankara, Turkey
2006	10th Conference	Penn State University, Great Valley Campus, Malvern, USA
2008	11th Conference	University of Limerick, Limerick, Ireland
2010	12th Conference	ETH, Zurich, Switzerland

In addition, the Mechatronics Forum is organising the 10th International Workshop on Mechatronics Education and Research in (REM). This is a European network of universities active in mechatronics and the conference will be held in 2009 at the University of Strathclyde in Glasgow.

Mechatronics Forum Prestige Lectures

One of the principal activities of the Mechatronics Forum has been the organisation of a series of Prestige Lectures. The lectures in this series to the time of writing are:

1995	<i>The Role of Xero-Mechatronics in New Product Development</i> Dr John F Elter of the Xerox Corporation
1996	<i>Advances in Mechatronics: the Finnish Perspective</i> Vesa Salminen of FIMET

⁴ Both the 1st and 2nd conferences were held before the Mechatronics Forum was formally constituted, but were instrumental in its establishment and hence are included in the list of conferences. After the Robinson College conference, it was agreed that subsequent conferences should come under the auspices of the Mechatronics Forum and be held biennially.

- 1997 *The Industrial Benefits of Mechatronics: the Dutch Experience*
Professor Job van Amerongen of the University of Twente
- 1998 *Virtual Worlds – Real Applications: Industrial and Commercial Developments in the UK*
Professor Bob Stone of the University of Birmingham,
- 2000 *Mechatronic Solutions for Industry*
Professor Rolf Isermann of the University of Darmstadt
- 2001 *Intelligent Mechatronics: Where to go?*
Professor Toshio Fukuda of Nayaga University
- 2003 *Bionics: New Human Engineered Therapeutic Approaches to Disorders of the Nervous System*
Professor Richard Normann of the University of Utah
- 2004 *GM's Approach to Eliminating Complexity and Making the Business More Successful*
Dr Jeffrey D Tew of General Motor's R&D Center
- 2005 *Mechatronic Design Challenges in Space Robotics*
Dr Cock Heemskerk & Dr Marcel Ellenbroek of Dutch Space
- 2006 *Cyborg Intelligence: Linking Human and Machine Brains*
Professor Kevin Warwick of the University of Reading
- 2007 *Iterative Learning Control – From Hilbert Space to Robotics to Healthcare Engineering*
Professor Eric Rogers of the University of Southampton
- 2008 *World Water Speed Record Challenge – The Quicksilver Project*
Nigel Macknight, Team Leader and Driver, Quicksilver (WSR) Ltd
- 2009 *Meeting the Challenges and Opportunities of Sustainability Through Mechatronic Product Development*
Professor Tim McAloone of the Technical University of Denmark

Mechatronics Forum Events

The Mechatronics Forum also organises short one-day events on specific topics of interest for the benefit of its members. The following is a selection of the topics covered over the years:

- 1991 *Mechatronic Design for the Machining of Exotic Materials*
Seminar held at Leicester Polytechnic⁵
- 1994 *Mechatronics – the Japanese Way*
Colloquium held at the IMechE in London
- 1995 *Innovative Actuators for Mechatronics Systems*
Colloquium held at the IEE Savoy Place in London

⁵ Now De Montfort University

- 1996 *Mechatronics Education*
Colloquium held at Manchester Metropolitan University
- 1996 *Mechatronics in Automated Handling*
Royal Mail Technology Centre, Swindon
- 1996 *The Industrial Benefits of Mechatronics: The Scandinavian Experience*
Colloquium held at the IEE headquarters at Savoy Place in London
- 1996 *Process Control and Robotics*
IMechE in London
- 1997 *Mechatronic Systems*
Workshop with Professor Rolf Isermann of Darmstadt University held at the IEE headquarters at Savoy Place in London
- 1997 *Intelligent Machines and Systems: the Implications for Mechanical Engineering*
Workshop with Professor George Rzevski of the Open University held at the IMechE in London
- 1997 *Design of Modern Manufacturing Machinery*
Colloquium held at the IMechE in London
- 1997 *Total Design of Mechatronics Systems*
Workshop held at the University of Bath
- 1998 *Choosing and Using PLCs*
Colloquium held at the IEE Savoy Place and the University of Birmingham
- 1998 *Learning from the Japanese Experience*
Colloquium held at the IEE Savoy Place in London
- 1998 *Mechatronics Mini Symposium*
Symposium at the IMechE Control 98 Conference at the University of Wales, Swansea
- 2002 *Future Trends in Robotics*
Seminar at the IMechE in London
- 2003 *Mechatronics in Medicine*
Symposium at Loughborough University
- 2008 *Robotics in Medicine*
Symposium at the IMechE in London

Mechatronics Forum Technical Visits

Over the years, the Mechatronics Forum organised a number of technical visits to leading companies for its members. The following is a selection of some of the companies visited:

Alcan (Bridgenorth)	Analog Devices (Limerick)
BAe Warton	Brinton Carpets, Kiddeminster
British Aerospace (Brough)	British Nuclear Fuels (Springfields)

British United Shoe Machinery (Leicester)	Cirrus Technologies (Redditch)
Control Techniques (Newtown, Powys)	Cranfield University CIM Institute
Cybernetics Institute, University of Salford	Defense Research Agency (Chertsey)
Exitech (Oxford)	FeONIC Plc, University of Hull
Flymo (County Durham)	Ford (Dagenham)
IBM (Greenock)	Komatsu (Redditch)
Lucas Advanced Engineering Centre (Shirley)	Mars Confectionery (Slough)
Mitsubishi Technology Centre (Hatfield)	Motorola (Easter-Inch, Edinburgh)
NCR (Dundee)	National Oceanographic Centre (Southampton)
Pioneer Electronics (Castleford)	Rank Taylor Hobson (Leicester)
Renishaw Metrology (Wotton-under-Edge)	Rover Powertrain Division of Rover Cars Ltd.
Royal Mail Technology Centre (Swindon)	Salford Advanced Robotics Research Centre
Siemens (Oxford) Magnet Technology	University of Hull
Yamazaki Mazak Machine Tools (Worcester)	

Mechatronics Student of the Year Award

The Mechatronic Forum also offers the Mechatronics Engineering Student of the Year Award, which has been specifically designed to help raise the profile of mechatronics design philosophy and mechatronics engineering education. The award provides a showcase for educational excellence by publicly recognising and rewarding the exceptional achievements of both students and universities. The competition is based around a submission of student's individual final year project report, or the group project report.

Entries are required to demonstrate:

- the application of mechatronics design philosophy to a specific engineering problem;
- an economically feasible solution in terms of its potential application in industry;
- excellent research and development practice, and final presentation.

The top three to five entrants are normally invited to the Finals where each student is required to present their project to the judges, who themselves are all engineers working in mechatronics.

Preface

Geoff Roberts¹

Worldwide interest in *mechatronics* and its associated activities continue to grow annually. One indicator of this growth is the large number of mechatronics-based conferences on offer. When the first of what became the Mechatronics Forum conferences was organised in 1989, this was the only conference series which had mechatronics in its title. Searching the internet today reveals a myriad of national and international groups and organisations promoting mechatronics events

As Memiş Acar says in his history of the Mechatronics Forum which appears as the Forward to this book, the word *mechatronics* is generally taken as having being coined in the early 1970s by Tetsuro Mori of the Yaskawa Electric Co. in Japan. Interestingly, from 1972 to 1982, *mechatronics* was a registered trademark of the Yaskawa Electric Co. It was not until the early 1980s that other organisations began to use the term in order to describe the philosophy of design teams.

Long before the word mechatronics came into general use it was recognised in industry that in order to facilitate innovation and increased efficiency in manufacturing and product design, it was vital for engineers and technicians from the disciplines of *mechanics* and *electronics* to work in synergy as teams rather than independently.

In my particular research area of marine systems, it is well known that the pioneering work of both Minorski [1] and Sperry [2] during the first quarter of the 20th century led to the development of automatic steering, or the ship steering autopilot. The evolution of the autopilot was itself made possible by the parallel development of powered rudders, or steering machines, and especially the electrically driven gyrocompass which overcame the problems associated with magnetic compasses which had their readings corrupted by local magnetic fields and the electrical systems in ships. Indeed, the invention of the electrically driven gyrocompass is arguably the most important breakthrough in ship control systems design, and its incorporation into the ship steering autopilot is probably one of the first examples of *mechatronics in action*.

The important legacy of Sperry and Minorski's innovative work and their seminal publications is the three-term or proportional-integral-derivative (PID)

¹ Coventry University, UK

controller which continues to be the industry preference and standard for automatic control systems.

Whilst the above focuses on marine systems, it is evident that the mechatronics philosophy encompasses many disciplines and applications, a fact which is not only succinctly reinforced by David Bradley and David W. Russell's introductory chapter to this book, but also by the range of topics presented in the accompanying chapters. John Millbanks's chapter covering the interrelationship of mechatronics and sustainability is a timely reminder that the mechatronics philosophy in more than simply ensuring the initial product design is right; it is equally applicable for whole life/cradle-to-grave considerations. Other important and key applications of *mechatronics in action* which are at the leading edge of technological developments pertain to road, rail and air transportation systems, i.e., fly-by-wire, steer-by-wire, brake-by-wire, tilting trains, aircraft and space vehicles, where embedded microprocessor systems facilitate and augment the necessary interface between electrical and mechanical components and subsystems.

The book also contains two chapters which address mechatronics education, an area that is often popular and well-attended at sessions at the Mechatronics Forum and other conferences. It is pleasing to see that mechatronics courses at pre-degree, degree and post graduate levels offered by universities in Europe, the Far East and America are on the increase, but disappointing that in the United Kingdom, mechatronics courses have not been as popular as would be expected. This is the case despite the UK industry's well-publicised requirements for engineers and technicians who are well-versed in both electrical and mechanical engineering.

A solution to this is for bodies such as the Mechatronics Forum to continue to promote the mechatronics philosophy through its conferences, seminars lectures and books. I therefore commend the authors for producing this extremely informative combination of topics, which taken together, demonstrate the importance of mechatronics and the significant impact that *mechatronics in action* has on our daily lives.

References

1. Minorski N (1922) Directional stability of automatically steered bodies, J. American Society of Naval Engineers, 34;280–309.
2. Sperry EA (1922) Automatic steering, Trans. Society of Naval Architects and Marine Engineers;61–63.

Mechatronics in Action

Case Studies in Mechatronics - Applications and
Education

Bradley, D.; Russell, D.W. (Eds.)

2010, XVII, 263 p., Hardcover

ISBN: 978-1-84996-079-3