

Multi-paradigm
Modelling for
Cyber - Physical
Systems

MPM⁴
CPS

Tackling engineering complexity

Truly complex, designed systems, known as Cyber Physical Systems (CPS), are emerging that integrate physical, software, and network aspects. To date, no unifying theory nor systematic design methods, techniques and tools exist for such systems. Individual (mechanical, electrical, network or software) engineering disciplines only offer partial solutions. Multi-paradigm Modelling (MPM) proposes to model every part and aspect of a system explicitly, at the most appropriate level(s) of abstraction, using the most appropriate modelling formalism(s). In other words, using the most appropriate paradigm. Modelling languages engineering, including model transformation, and the study of their semantics, are used to realize MPM. MPM is seen as an effective answer to the challenges of designing CPS.

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Observer Countries: IL, NZ, USA



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Objectives

Enhance the quality, visibility and impact of European research and industrial adoption in the trans-disciplinary area of CPS

- Establish the foundations and methods of CPS Engineering enabled by MPM.
- Coordinate and shape the efforts on research, education and application in this emerging research field.
- Promote the sharing of foundations, techniques, tools and experiences.
- To provide educational resources, to both academia and industry.

Working Groups

WG1: Foundations

- Characterize/categorize (chart) existing modelling languages used in the different disciplines using typical industrial CPS scenarios
- Develop MPM framework to relate/combine (unify) modelling languages and techniques
- Apply and mostly combine MPM, Control, Hybrid Systems, while dealing with the heterogeneity of CPS, and identifying common formalisms and ontologies used in CPS

WG3: Application Domains

- Definition of Benchmark Case Studies
 - Assess current industrial state of MPM4CPS
- Collect the requests and requirements of each application domain, and rewrite them from a CPS perspective, look for commonalities/differences.
- Assess the suitability of the different application domain models from a CPS perspective (e.g., completeness, usability, interoperability with existing tools, etc.)

What is COST

COST is an intergovernmental framework for European co-operation in the field of Scientific and Technical Research, allowing the co-ordination of nationally funded research activities on a European level. The goal of COST is to ensure that Europe holds a strong position in the field of scientific and technical research for peaceful purposes, by increasing European co-operation and interaction in this field. COST is based on Actions. These are networks of coordinated national research projects in fields, which are of interest to participants from at least five different member states.



REACH US_ <http://mpm4cps.eu>

WG2: Foundations

- Investigate current standards and best practices (modelling languages, interfaces for interoperability, processes, ...) used in CPS
- Survey state-of-the art on MPM tools and techniques used in different disciplines for CPS development including an efficiency evaluation of MPM tools and techniques on CPS.

WG4: Education and Dissemination

- Identify the adequate profile(s) of CPS experts
- Chart existing courses in the realm of MPM4CPS in Europe, and the need for new courses on topics relevant to CPS
- Lay out the basis for an European Master/Phd Program in MPM4CPS involving several European leading Universities (and companies)
 - Promote literature on the topic (books, articles), while defining course material (online, etc)
 - Training/Summer Schools on MPM4CPS
 - Make young students (future researchers and practitioners) aware of and enthusiastic about the topic of CPS