

1. Record Nr.	UNINA9910580256703321
Autore	Cardin Olivier
Titolo	Digitalization and Control of Industrial Cyber-Physical Systems : Concepts, Technologies and Applications
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2022 ©2022
ISBN	1-119-98742-3 1-119-98740-7
Descrizione fisica	1 online resource (348 pages)
Altri autori (Persone)	DerigentWilliam TrentesauxDamien
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di contenuto	Cover -- Half-Title Page -- Title Page -- Copyright Page -- Contents -- Foreword -- Introduction -- PART 1: Conceptualizing Industrial Cyber-Physical Systems -- 1. General Concepts -- 1.1. Industry at the heart of society -- 1.2. Industrial world in search of a new model -- 1.3. Cyber-physical systems -- 1.4. From cyber-physical systems to industrial cyber-physical systems -- 1.5. Perspectives on the study of industrial cyber-physical systems -- 1.6. References -- 2. Moving Towards a Sustainable Model: Societal, Economic and Environmental -- 2.1. Industry of the future and sustainable development -- 2.2. Contribution of ICPS to the social dimension -- 2.2.1. Background -- 2.2.2. Cognitive aspects -- 2.2.3. Health and safety aspects at work -- 2.3. Contribution of ICPS to the environmental dimension -- 2.3.1. Objectives and expectations -- 2.3.2. Example of application -- 2.4. Contribution of ICPS to the economic dimension -- 2.5. Conclusion -- 2.6. References -- PART 2: Sensing and Distributing Information Within Industrial Cyber-Physical Systems -- 3. Information Flow in Industrial Cyber-Physical Systems -- 3.1. Introduction -- 3.2. Information and decision loops when using an ICPS -- 3.3. Decision-making processes within the loops of an ICPS -- 3.3.1. Nature of decision-making processes -- 3.3.2. Nature of information -- 3.3.3. Approach to studying the informational loops of the cyber part of an ICPS -- 3.4.

Elements for the implementation of loops -- 3.4.1. Generic architecture -- 3.4.2. Link to decision-making processes and the nature of the information -- 3.5. Illustrative examples -- 3.5.1. Example from rail transport -- 3.5.2. Example from the manufacturing sector -- 3.6. Conclusion -- 3.7. References -- 4. The Intelligent Product Concept -- 4.1. The intelligent product, a leading-edge concept in industrial cyber-physical systems. 4.2. Definitions of the intelligent product concept -- 4.3. Developments in the concept of intelligent products -- 4.3.1. Group 1: product-driven systems (PDS) -- 4.3.2. Group 2: product lifecycle information management (PLIM) -- 4.4. Conclusions and perspectives on the intelligent product -- 4.5. References -- PART 3: Digitalizing at the Service of Industrial Cyber-Physical Systems -- 5. Virtualizing Resources, Products and the Information System -- 5.1. Virtualization - the technology for industrial cyber-physical systems -- 5.2. Virtualization in the industrial environment -- 5.3. Shop floor virtualization of resource and product workloads -- 5.3.1. Resource and product virtualization through shop floor profiles -- 5.3.2. Virtualization of collaborative product and resource workloads -- 5.4. MES virtualization in the cloud (vMES) -- 5.5. Perspectives offered by virtualization to industry of the future -- 5.6. References -- 6. Cybersecurity of Industrial Cyber-Physical Systems -- 6.1. What are the risks involved? -- 6.1.1. Unavailability of systems -- 6.1.2. Loss of confidentiality or integrity -- 6.1.3. Bypassing access and authentication controls -- 6.2. What means of protection? -- 6.2.1. Ensuring availability -- 6.2.2. Ensuring confidentiality -- 6.2.3. Implementing authentication mechanisms -- 6.2.4. Controlling access, permissions and logging -- 6.3. Conclusion -- 6.4. References -- PART 4: Controlling Industrial Cyber-Physical Systems -- 7. Industrial Agents: From the Holonic Paradigm to Industrial Cyber-Physical Systems -- 7.1. Overview of multi-agent systems and holonics -- 7.1.1. Multi-agent systems -- 7.1.2. Holonic paradigm -- 7.2. Industrial agents -- 7.2.1. Definition and characteristics -- 7.2.2. Interfacing with physical assets -- 7.3. Industrial agents for realizing industrial cyber-physical systems. 7.3.1. Supporting the development of intelligent products, machines and systems within cyber-physical systems -- 7.3.2. Implementing an industrial multi-agent system as ICPS -- 7.4. Discussion and future directions -- 7.5. References -- 8. Holonic Control Architectures -- 8.1. Introduction -- 8.2. HCA fundamentals -- 8.3. HCAs in the physical part of ICPS -- 8.4. Dynamic architectures, towards a reconfiguration of the physical part from the cyber part of ICPS -- 8.5. HCAs and Big Data -- 8.6. HCAs and digital twin: towards the digitization of architectures -- 8.7. References -- PART 5: Learning and Interacting with Industrial Cyber-Physical Systems -- 9. Big Data Analytics and Machine Learning for Industrial Cyber-Physical Systems -- 9.1. Introduction -- 9.2. Data massification in industrial cyber-physical systems -- 9.3. Big Data and multi-relational data mining (MRDM) -- 9.3.1. Formal concept analysis (FCA) -- 9.3.2. Relational concept analysis (RCA) -- 9.4. Machine learning -- 9.4.1. Basics of machine learning -- 9.4.2. Multilayer perceptron (MLP) -- 9.5. Illustrative example -- 9.6. Conclusion -- 9.7. References -- 10. Human-Industrial Cyber-Physical System Integration: Design and Evaluation Methods -- 10.1. Introduction -- 10.2. Design methods -- 10.3. Method of integrating HICPS -- 10.3.1. Descending phase -- 10.3.2. Ascending phase -- 10.4. Summary and conclusion -- 10.5. References -- PART 6: Transforming Industries with Industrial Cyber-Physical Systems -- 11. Impact of Industrial Cyber-Physical Systems on

Reconfigurable Manufacturing Systems -- 11.1. Context -- 11.1.1. Developments -- 11.1.2. Issues -- 11.1.3. Resources -- 11.2. Reconfiguration -- 11.2.1. Implementation and decision levels -- 11.2.2. Information systems -- 11.2.3. Adaptation in the context of CPPS/RMS -- 11.2.4. Where and when to reconfigure? -- 11.3. Modeling. 11.3.1. Data collection -- 11.3.2. Simulation platforms -- 11.4. Ergonomics/cognitive aspects -- 11.5. Operation of the information system -- 11.5.1. Operational level: procurement -- 11.5.2. Responding to disruptions -- 11.5.3. Decision support -- 11.6. Illustrative example -- 11.7. References -- 12. Impact of Industrial Cyber-Physical Systems on Global and Interconnected Logistics -- 12.1. Logistics and its challenges -- 12.2. Contemporary logistics systems and organizations -- 12.2.1. Intra-site logistics -- 12.2.2. Intra-urban logistics -- 12.2.3. Inter-site inter-city logistics -- 12.3. The Physical Internet as a modern and promising logistics organization -- 12.3.1. Concept and definition -- 12.3.2. Topologies of networks of networks -- 12.4. Perspectives of ICPS applications in interconnected logistics: the example of the Physical Internet -- 12.4.1. Modeling the Physical Internet by ICPS: the example of routing -- 12.4.2. Exploiting ICPS: the data-driven approach and the digital twin-driven approach -- 12.5. Conclusion -- 12.6. References -- 13. Impact of Industrial Cyber-Physical Systems on Transportation -- 13.1. Introduction -- 13.1.1. Pull forces -- 13.1.2. Complexity factors of the transportation sector -- 13.1.3. Push forces -- 13.2. The impact of ICPS on transportation -- 13.3. Rail transportation service: an illustrative example -- 13.3.1. The physical space of SUPERFLO -- 13.3.2. The human fleet supervisor -- 13.3.3. The cyber space of SUPERFLO -- 13.3.4. Evaluation of the proposed model and industrial expectations -- 13.4. Concluding remarks -- 13.5. Acknowledgments -- 13.6. References -- 14. Impacts of Industrial Cyber-Physical Systems on the Building Trades -- 14.1. General introduction -- 14.2. The place of BIM in Construction 4.0 -- 14.3. Examples of transformations in the construction sector. 14.3.1. Control: real-time site management -- 14.3.2. Learning and interacting: virtual reality and machine learning -- 14.3.3. Capturing and distributing: use of wireless technologies (RFID and WSN) -- 14.3.4. Digitalizing: digitalizing technologies for BIM -- 14.4. Example of ICPS in construction -- 14.5. Achieving the digital transformation of businesses -- 14.6. References -- 15. Impact of Industrial Cyber-Physical Systems on the Health System -- 15.1. Introduction -- 15.1.1. The health system and its specificities -- 15.1.2. The digital evolution of healthcare production and health -- 15.2. HCPS in the literature -- 15.2.1. HCPS for medical monitoring -- 15.2.2. HCPS for well-being and prevention -- 15.2.3. HCPS for organizational monitoring of patient pathways -- 15.2.4. Sensors for monitoring patients and resources -- 15.3. The contribution of a digital twin in an HCPS -- 15.3.1. General principle of digital twins in health -- 15.3.2. A proposal for an HCPS based on a digital twin of patient pathways in the hospital -- 15.4. Conclusion -- 15.5. References -- PART 7: Envisioning the Industrial Cyber-Physical Systems of the Future -- 16. Ethics and Responsibility of Industrial Cyber-Physical Systems -- 16.1. Introduction -- 16.2. Ethics and ICPS -- 16.2.1. Data management and protection -- 16.2.2. Control in the design of algorithms -- 16.3. Liability and ICPS -- 16.3.1. Existing liability regimes applied to ICPS -- 16.3.2. Proposals for changes in liability regimes -- 16.4. References -- 17. Teaching and Learning ICPS: Lessons Learned and Best Practices -- 17.1. Introduction -- 17.2. University of Warwick - Bachelor-level

curriculum -- 17.2.1. ICPS education: Fusion of computer science and engineering -- 17.2.2. Key enabling technologies in the ICPS curriculum -- 17.2.3. Pedagogical principles: teaching ICPS modules.
17.3. University of Applied Sciences Emden/Leer - master's-level curriculum.
