1. Record Nr. UNINA9911019233503321

Autore	Moinuddin Syed Quadir
Titolo	Automation in the Welding Industry : Incorporating Artificial Intelligence, Machine Learning and Other Technologies
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2024 ©2024
ISBN	9781394172948 139417294X 9781394172931 1394172931
Edizione	[1st ed.]
Descrizione fisica	1 online resource (307 pages)
Collana	Industry 5. 0 Transformation Applications Series
Altri autori (Persone)	Himam SahebShaik DewanganAshok Kumar CheepuMurali Mohan PalamurukanCa
Disciplina	671.52028563
Soggetti	Welding - Automation Artificial intelligence - Industrial applications
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Dedication Page -- Contents -- Preface -- Acknowledgments -- Chapter 1 Introduction to Industry 5.0 -- 1.1 Introduction -- 1.2 Industry 4.0 -- 1.3 Industry 5.0 -- References -- Chapter 2 Advancements in Welding Technologies -- 2.1 Introduction -- 2.2 Quality of Weld Joint -- 2.3 Pulsed Current GMAW -- 2.4 P-GMAW Process Stability Factors -- 2.5 Suitable Pulse Parameters of Selection -- 2.6 Effect of Pulse Parameters -- 2.6.1 Weld Bead Geometry -- 2.6.2 Weld Dilution -- 2.6.3 Weld Microstructure -- 2.7 Pulsed Current GMAW Advances -- 2.8 Double-Pulsed GMAW -- 2.9 Synergic Control -- 2.10 Self-Regulating Control -- 2.11 Microcomputer Control -- 2.12 GMAW Shielding Gas Flow -- 2.13 Particle Image Velocimetry (PIV) -- 2.14 The Measurement of Oxygen (O2) Concentration -- 2.15 Spectroscopic Measurements of Plasma Temperature -- 2.16 P-GMAW Numeric Simulation -- 2.16.1 Approach-1 -- 2.16.2 Approach-II -- References -- Chapter 3

Automation in Welding Industries -- 3.1 Introduction -- 3.1.1 Types of Automatic Welding -- 3.1.2 Challenges of Automatic Welding -- 3.1.3 Benefits of Automatic Welding -- 3.2 Automation Trends -- 3.2.1 Production Monitoring -- 3.2.2 Adaptive Welding Advancements -- 3.2.3 Upstream Practices -- 3.2.4 Collaborative Technology -- 3.2.5 Easier Programming of Automation Systems -- 3.3 Plasma Welding -- 3.4 Laser Welding -- 3.5 Arc Welding -- 3.6 MIG Welding -- 3.7 Resistance Welding -- 3.8 Conclusions -- References -- Chapter 4 Digitalization of Welding Processes -- 4.1 Introduction -- 4.2 Techniques for Process Monitoring -- 4.2.1 Electrical Process Tests: Voltage and Current for Welding -- 4.2.2 Thermal Measurement -- 4.2.3 Optical Measurement -- 4.2.4 Acoustic Measurement -- 4.2.5 Measurement of Displacement and Velocity -- 4.2.6 Measurement of Force -- 4.3 Process Monitoring Applications.
4.3.1 Measurement of Current and Voltage -- 4.3.2 Thermal Measurement -- 4.3.3 Optical Measurement -- 4.3.4 Acoustic Measurement -- 4.3.5 Displacement and Velocity Measurement -- 4.3.6 Measurement of Force -- 4.3.7 EMF Measurement -- 4.4 Future Directions -- References -- Chapter 5 AI and ML in Welding Technologies -- Nomenclature -- 5.1 Introduction -- 5.2 Enhancing the Welding Industry -- 5.3 Machine Learning Algorithm Types -- 5.4 Background of AI and ML -- 5.5 Weld Defects -- 5.6 Level of Weld Quality -- 5.6.1 Mining Industry -- 5.6.2 Challenges in ML Practice -- 5.7 Case Studies -- 5.7.1 Use of AI Programs to Obtain CCT Welding Diagrams -- 5.7.2 Use of Algorithms to Predict the Penetration Depth in Friction Stir Spot Welding -- 5.8 Feasibility of Online Inspection of Ultrasonic Weld Quality -- 5.9 Conclusions -- References -- Chapter 6 Digital Twin in Welding -- 6.1 Introduction -- 6.2 Friction Stir Welding -- 6.2.1 FSW Parameters -- 6.3 Defects in Friction Stir Welding -- 6.3.1 DT for FSW -- 6.4 Laser Welding -- 6.4.1 Heat Conduction Welding -- 6.4.2 Deep Penetration or Keyhole Welding -- 6.4.3 Weld Process Parameters -- 6.4.3 DT for Laser Welding -- 6.5 Summary -- References -- Chapter 7 IoT in Welding Industries -- 7.1 Introduction -- 7.2 Sensing and Analyzing Welding Data via the Internet of Things (IoT) -- 7.2.1 Electrical Information -- 7.2.2 Optical Information -- 7.3 Welding Manufacture Based on IoT -- 7.3.1 Example 1: Arc Quality Management with IoT -- 7.3.2 Example 2: Case Study on IoT-Enabled Molten Metal Temperature Sensing System for Welding -- 7.3.3 Example 3: IoT-Based Safety Monitoring System During Welding Operations -- 7.3.4 Example 4: IoT-Based Monitoring of Submerged Arc Welding Process -- 7.4 Conclusion -- References -- Chapter 8 VR and AR in Welding Technologies -- 8.1 Introduction -- 8.1.1 Virtual Reality (VR).
8.1.2 Augmented Reality (AR) -- 8.1.3 Artificial Intelligence (AI) -- 8.1.4 Machine Learning (ML) -- 8.2 How Intelligent is AI When Coupled with VR/AR? -- 8.3 VR/AR Architecture -- 8.4 Welding Processes -- 8.5 Intelligent Welding Technology -- 8.6 Types of Intelligent Welding Processes -- 8.6.1 Types of Welding Positions -- 8.7 Automated Welding Examples -- 8.7.1 Computer Interface of Automated Welding Processes -- 8.8 Applications of VR and AR in Automated Welding -- 8.9 AI and ML for Visual Inspection of Welds -- 8.9.1 AI in Arc Welding -- 8.9.2 AI Detection of Welding Defects -- 8.9.3 VR/AR Welding Simulator -- 8.10 Limitations in the Existing State-of-the-Art Welding Techniques -- 8.10.1 Advantages of AR/VR -- 8.11 Conclusions -- References -- Chapter 9 Intelligent, Clean Cobot Arc Welding Cell -- 9.1 Chances for SMEs -- 9.1.1 Introduction and Goals -- 9.2 Parameters and Consumption Data -- 9.3 CO2 Footprint Methodology -- 9.4 Result Presentation -- 9.5 Conclusion -- Acknowledgments --

References -- Chapter 10 Welding-Based 3D, 4D, 5D Printing -- Nomenclature -- 10.1 Introduction -- 10.2 Differences Among 3DP, 4DP and 5DP -- 10.3 Materials Used in 3DP, 4DP and 5DP Processes -- 10.3.1 Additive Manufactured Metallic Components -- 10.4 Machinability of Welded Components -- 10.5 Concept of 4D and 5D Printing -- 10.6 FEM-Based Analysis -- 10.7 Applications -- 10.7.1 4D Printing Applications -- 10.7.2 3D Printing in the Aerospace Industry -- 10.7.3 3D Printing in Electronics -- 10.7.4 3D Printing in Electrochemical Industries -- 10.7.5 5D Printing in Dentistry -- 10.7.6 5D Printing in Orthopedics -- 10.8 Conclusions -- References -- Chapter 11 Welding and Joining of Novel Materials -- 11.1 Introduction -- 11.1.1 Concept of High Entropy Alloys (HEAs) -- 11.2 Core Effects -- 11.2.1 High Entropy Effect -- 11.2.2 Sluggish Diffusion Effect. 11.2.3 Severe Lattice Distortion Effect -- 11.2.4 Cocktail Effect -- 11.2.5 Current Status of HEAs -- 11.3 Arc Welding Techniques for HEAs -- 11.4 Solid State Welding -- 11.4.1 Friction Stir Welding (FSW) -- 11.5 Explosive Welding -- 11.5.1 Soldering and Brazing -- 11.6 EBW and EBC of HEAs -- 11.7 Laser Welding of HEAs -- 11.8 Laser Cladding of HEAs -- 11.9 Conclusion and Summary -- References -- Chapter 12 Sustainability in Welding Industries -- 12.1 Introduction -- 12.2 Critical Factors for Sustainability of Welding -- 12.3 Adoptability of Sustainable Welding -- 12.4 New Welding Standards for Sustainability -- 12.5 Resource-Conserving Techniques -- 12.5.1 Sustainable Welding in Practice -- 12.5.2 Boosting Efficiency with Special Welding Processes -- 12.6 Sustainability in Welding Training -- 12.6.1 Sustainable Technologies for Thick Metal Plate Welding -- 12.7 5S Lean Strategy for a Sustainable Welding Process -- 12.7.1 Sustainability Assessment of Shielded Metal Arc Welding (SMAW) Process -- 12.8 A-TIG Welding: A Small Step Towards Sustainable Manufacturing -- 12.8.1 Weight Space Partitions-Based Sustainable Welding -- 12.8.2 Sustainability Assessment of Welding Processes -- 12.8.3 Sustainability in Manufacturing -- 12.9 Sustainability Indices -- 12.10 Conclusion -- References -- Chapter 13 Global Welding Market Growth -- 13.1 Introduction -- 13.1.1 Overview of Global Welding Products Market -- 13.2 Patrons of Global Welding Market -- 13.3 Welding Technologies in the Global Welding Market -- 13.4 Fluxes, Wires, Electrodes, and Fillers -- 13.5 Welding Market Dynamics -- 13.6 Manpower and Labor Challenges in Global Market -- 13.7 COVID-19's Impact on Global Welding Materials Market -- 13.8 New Opportunity in the Welding Market and Advanced Applications -- 13.9 Conclusions -- References. Chapter 14 Quality Assurance and Control in Welding and Additive Manufacturing -- 14.1 Introduction -- 14.2 Quality Issues in Welding -- 14.3 Quality Issues in 3D Printing -- 14.4 Conclusion -- References -- Chapter 15 Welding Practices in Industry 5.0: Opportunities, Challenges, and Applications -- 15.1 Introduction -- 15.2 Manufacturing Trends -- 15.3 Welding Technology -- 15.3.1 Classification of Welding -- 15.4 Variety of Materials Used by Welding for Industry 5.0 -- 15.4.1 Advantages of Welding -- 15.4.2 Applications -- 15.4.3 Automation -- 15.4.4 Welding-Based AM -- 15.4.5 Welding Trends in Aeronautic Industry -- 15.4.6 Robotic and Automated Welding -- 15.5 Virtual Reality (VR) for Welders -- 15.6 Challenges and Opportunities in Nuclear Reactor -- 15.7 Challenges of AM-Based Functionally Graded Materials Through LDED -- 15.8 Conclusion -- References -- Index -- EULA.

Sommario/riassunto

This book delves into the transformative potential of Industry 5.0, focusing on the integration of human intelligence with advanced technologies such as artificial intelligence, machine learning, and data analytics in the field of welding. It explores various aspects of

automation in welding, including advancements in welding technologies, the role of AI and machine learning, and the implementation of digital twins and the Internet of Things (IoT) in welding industries. The book also discusses the use of virtual and augmented reality in welding processes and the development of intelligent and clean cobot arc welding cells. It is intended for professionals and researchers in the welding industry seeking to understand and apply cutting-edge technologies for enhanced efficiency and innovation.