

# Robotics and automation in the food industry: Current and future technologies

## Contents

### PART 1 INTRODUCTION, KEY TECHNOLOGIES AND SIGNIFICANT AREAS OF DEVELOPMENT

#### **Automatic process control for the food industry: an introduction**

*Y Huang, United States Department of Agriculture, USA*

- Introduction
- Process control systems and structure in the food industry
- Process control methods in the food industry
- Future trends
- References

#### **Robotics in the food industry: an introduction**

*J O Gray, The University of Manchester and S T Davis, University of Salford, UK*

- Introduction
- Current manufacturing procedures
- Automation in the food sector
- Specifications for a food sector robot
- Future trends
- Conclusion
- References

#### **Sensors for automated food process control: an introduction**

*P G Berrie, Endress+Hauser Process Solutions AG, Switzerland*

- Introduction
- Special considerations for food instrumentation
- Measurement methods
- Device integration
- Applications of sensors in automated food process control
- Future trends
- Conclusion
- References

#### **Machine vision in the food industry**

*E R Davies, Royal Holloway, University of London, UK*

- Introduction
- Machine vision: principles and methods
- Applications and case studies
- Recent advances in the application of vision in the food industry
- Appraisal of the need for special hardware for food inspection applications
- Conclusion and future trends
- Sources of further information and advice
- References

#### **Optical sensors and online spectroscopy for automated quality and safety inspection of food products**

*C B Singh and D S Jayas, University of Manitoba, Canada*

- Introduction
- Optical sensing and spectroscopic techniques
- Applications in the food industry
- Future trends
- Conclusion
- References

### **Supervisory control and data acquisition (SCADA) and related systems for automated process control in the food industry: an introduction**

*J F Holmes and G Russell, Georgia Tech Research Institute, USA and J K Allen The University of Oklahoma, USA*

- Introduction to supervisory control and data acquisition (SCADA) History of SCADA
- SCADA standards and applications
- SCADA in food processing
- Laboratory study: implementation of SCADA
- Future trends in SCADA
- References

### **Gripper technologies for food industry robots**

*T K Lien, Norwegian University of Science and Technology, Norway*

- Introduction
- Gripper challenges in food process automation
- Gripping physics
- Pinching and enclosing grippers
- Penetrating (needle) grippers
- Suction grippers
- Surface effect (freeze) grippers
- Selection of the appropriate gripping technology
- Future trends: from laboratory to industry
- References

### **Wireless sensor networks (WSNs) in the agricultural and food industries**

*N Wang, Oklahoma State University, USA*

- Introduction
- Current state of development of wireless sensor networks (WSN)
- WSN applications in agriculture and food production
- Future trends in WSN technology in agriculture and food production
- References

### **Intelligent quality control systems in food processing based on fuzzy logic**

*N Perrot and C Baudrit, INRA, France*

- Introduction
- Principles of intelligent control systems using fuzzy logic
- Current applications in the food industry
- Advances in research and future trends
- References

### **Advanced methods for the control of food processes: the case of bioconversion in a fed-batch reactor**

*D Dochain, Universite catholique de Louvain, Belgium*

- Introduction
- The basic dynamical model
- Modelling issues: population balance modelling in food processes
- Monitoring issues
- Design of PID controllers for fed-batch processes
- Real-time optimization
- Acknowledgements
- Conclusion
- References

## **PART 2 ROBOTICS AND AUTOMATION IN PARTICULAR UNIT OPERATIONS AND INDUSTRY SECTORS**

### **Automation and robotics for bulk sorting in the food industry**

*G Hamid, B Deefholts, N Reynolds, D McCambridge, K Mason-Palmer and C Briggs, Bühler Sortex*

*Limited, UK*

- Introduction
- Principles of operation
- Requirements
- Recent advances in technology
- Current applications
- Conclusion
- Future trends
- Sources of further information and advice
- References

#### **Automatic control of food chilling and freezing**

*C James and S J James, Grimsby Institute of Further & Higher Education (GIFHE), UK*

- Introduction: key drivers and challenges for automatic control of food chilling and freezing
- Automation in refrigerated food retail display
- Automation of refrigeration and freezing operations in food catering
- Automation in refrigerated food transport systems
- Automation in food chilling and freezing systems
- Automation in food cold storage systems
- Advances in research and future trends
- Sources of further information and advice
- References

#### **Robotics and automation in meat processing**

*G Purnell, Grimsby Institute of Further & Higher Education (GIFHE), UK*

- Introduction
- Automation of carcass production processes before primary chilling
- Automation of carcass separation processes after primary chilling
- Future trends
- Conclusion
- Sources of further information and advice
- References

#### **Robotics and automation in the poultry industry: current technology and future trends**

*G McMurray, Georgia Tech Research Institute, USA*

- Introduction
- Robotics and automation in live hanging and first processing of poultry
- Robotics and automation in second processing of poultry
- Robotics and automation in bulk packing and shipping of poultry meat
- Future trends
- References

#### **Robotics and automation in seafood processing**

*J O Buljo and T B Gjerstad, SINTEF Raufoss Manufacturing AS, Norway*

- Introduction
- Technologies for robotics and automation in the seafood industry
- Application of robotics and automation in fish slaughtering, filleting, portioning and associated unit operations
- Automation in other unit operations in fish processing
- Future trends
- Sources of further information and advice
- References

#### **Robotics and automation in the fresh produce industry**

*N Kondo, Kyoto University, Japan*

- Introduction
- Machine vision system as a key technology
- Vegetable preprocessing and grading systems
- Information flow for food traceability and farming guidance

- Conclusion
- References

### **Robotics and automation for packaging in the confectionery industry**

*J S Dai, University of London, UK*

- Introduction
- The confectionery market and its business requirements
- Reconfigurable mechanism technology
- Case study of a reconfigurable system for carton folding
- Future trends
- Conclusion
- Acknowledgements
- References

### **Automatic control of batch thermal processing of canned foods**

*R J Simpson, S F Almonacid, Universidad Técnica Federico, Chile and Centro Regional de Estudios en Alimentos Saludables (CREAS), Chile, and A A Teixeira, University of Florida, USA*

- Introduction
- On-line control strategies
- Validation of computer-based control systems
- Industrial automation of batch retorts
- Advances in research and future trends
- References

### **Automation for a sustainable food industry: computer aided analysis and control engineering methods**

*A I Papadopoulos, Centre for Research and Technology - Hellas, Greece, and P Seferlis, Aristotle University of Thessaloniki, Greece and Centre for Research and Technology - Hellas, Greece*

- Introduction
- Definition of sustainability and links with the food industry
- Automation and sustainability in food manufacturing
- Tools for automated sustainable design and operation in food engineering
- Advanced tools and methods for sustainable food engineering with potential applications
- Software technologies for automated sustainable design
- Conclusion and future trends
- Sources of further information and advice
- References