

# contents

Introduction: Robots on the Floor

ix

## CHAPTER 1

### A Human Walks into an Assembly Cell... 1

A mix of different external safety systems can allow the whole human-machine interaction (HMI) assembly cell to work properly in an industrial context. The scenario for HMI, in this case, is that an operator enters a robot working area with the aim to perform an assembly task that requires two hands. There are different support systems that could be applied to this assembly application, but every one of these systems needs to coincide with official standards to be applied in an approved industrial HMI assembly cell.

- 1.1 What Is Safety?** 2
- 1.2 Support Systems** 4
- 1.3 The Test Setup** 4
- 1.4 Maximizing Productivity and Safety** 7

## CHAPTER 2

### Skills-Based Human-Robot Cooperation 11

Experience has led to current assembly concepts necessarily consisting of “customized automation.” The authors offer a structured approach to the analysis of assembly processes to extract the required information necessary for a skills-based task assignment to either humans or robots. The analysis begins with the assessment of a product and follows the process through to the assembly of aircraft fuselages. An advantage of this method is that the proportions of manual and automated tasks can get reassigned quickly and easily. Thus, the executing workforce can get chosen appropriately according to the relevant conditions.

- 2.1 State-of-the-Art Review** 12
- 2.2 A Structured Approach for a Task Analysis** 14
- 2.3 Demonstration Scenario Results** 19