Chapter 12

Prototyping of Robotic Systems in Surgical Procedures and Automated Manufacturing Processes

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ABSTRACT

The prototyping and implementation of robotic system is a scientific and technological integrating of robotic system design, development, testing, and application. This chapter describes the recent development and applications of robotic systems to surgery procedures in biomedical engineering and automated manufacturing processes in industry. It includes the design and development, computer-aided modeling and simulation, prototype analysis, and testing of robotic systems in these two different applications.

1. INTRODUCTION

Robotic system is constructed mechanically of kinematic chains and actuators which function as muscles that transfer potential energy to body motion (Dylan, 2005, p.797 & Schreuder, 2010, p.253). The robotic mechanisms can be controlled to perform different tasks. The applications of programmable logic control to the industry bring revolution for the manufacturing techniques. It allows more sophisticated, flexible, reliable, and cost-effective manufacturing process controls (Feil-Seifer, 2007, p.425 & Kim, 2007, p.13 & Yang, 2008, p.79). Robotic system is to use control system to reduce human labor intervention during manufacturing processes and productions. It plays very important role and puts strong impact in today’s industries (McComb, 2003, p.435 &
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2. BACKGROUND


Figure 2 shows the da Vinci robotics surgical system for gynecology, urogynecology, urology and cardiology procedures. It has flexible, safe, précised features that allows surgeon to operate the surgery with reduced trauma to the patients and a faster recovery time (Kwartowitz, 2006, p.157 & Li, 2002, p.90 & Melvin, 2003, p.33 & Passerotti, 2006, p.193 & Peters, 2007, p.179).

Figure 3 displays another robotic-assisted surgical system to help surgeon in surgery. It allows the surgeon to perform surgery with enhanced precision that reduces post-operative complications, less pain and discomfort after surgery, less scarring and a shorter hospital stay (Kypson, 2004, p.87 & Melvin, 2003, p.11 & Passerotti, 2006, p.193 & Patel, 2011, p.423).

The common robotic systems in manufacturing processes include robotics systems for picking and placing work pieces, assembling operations, and handling machine tools (DeLaurentis, 2002, p.91). The common type of robotic unit is the mechanical arms being used in industry and manufacturing processes (Desforges, 2011, p.963). This mechanism, like human arm, can perform many different motions, including left-and-right, up-and-down, and angular motions. Robotic arms can be either controlled through computer program or human interference. Industrial robots have a multi-linked manipulating arm.
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