

Chapter 23

Designing a Robot for Manufacturing Fiberglass Reinforced Plastic (FRP) Molded Grating

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ABSTRACT

The use of robotics in the industrial environment has, in general, very similar goals. Because of productivity requirements, or due to reliability, industries have been constantly equipping their floor with robots. In that sense, the chapter observed—in a fiberglass company—the chance of using a robot to execute a boring and repetitive task. The task mentioned is, actually, the manufacturing of fiberglass reinforced plastic (FRP) molded grating. To confirm the possibility of using a robot to this job, a cost and time analysis was made about the whole molded gratings manufacturing process. Afterward, research about robotics was taken in parallel with the conception of the robot (named “roving-robot”). Calculations were made to the mechanical project of the robot. Applying computer-aided design (CAD), technical drawing and bill of materials were generated to permit the robot assembling. All of these project steps are presented in this chapter.

INTRODUCTION

This chapter presents a project developed after a real problem faced by a fiberglass manufacturer in Brazil. The firm had been undergoing lack of productivity during the fabrication of molded fiberglass gratings (FRP gratings, or fiberglass reinforced plastic gratings). From 2014 to 2015, the company could not reach the high market demand in the country. In that way, a solution had to be achieved considering the identified bottleneck: the number of molds; also, taking into account the very tight budget available. According to the supply chain analysts, a new mold would cost around U\$43,000.00. Therefore, the use of robotics was suggested in order to reduce the task time of certain steps during the molded gratings production.

The main goal of the present chapter is to exhibit the mechanical conception of a robot capable of raising the FRP gratings productivity. Due to the shortage of money, it was used a low-cost and goal-focused mentality.

To familiarize the reader with specific subjects, the application of robotics in industrial environments will be briefly presented as background. In addition, the main focus of the chapter will be dedicated to summarize the main FRP products and their manufacturing methods.

After this, the reader will be capable of understanding the molded FRP gratings fabrication process. All the manufacturing steps will be described and analyzed in terms of time and cost. A specific model of grating will be selected to exemplify some calculations regarding the automation benefits. However, the estimations can be extended to any other similar product.

Subsequently, the reader will find some studies about the robotic branches. Between them, an introduction about this very recent science and the main classifications and components used to build a robot. Some specifications to the robotic solution proposed will be presented simultaneously to this review.

In the end of this chapter, the reader will find the conception of the robot shaped to solve the problem abovementioned. The knowledge of robotics already introduced helps the understanding of the choices made about mechanical elements. The robot concept will be fully presented by showing its computer aided design (CAD).

BACKGROUND

The Beginning of Robotics

The term “robot” has its origins at the Czech word “robota”, whose literal translation is “slave” (Brum, 2016). Karel Capek, the playwright that wrote a science fiction narrative called “Rossum’s Universal Robots”, first used this word on 1921. Then, “robot” was spread out when the writer Isaac Asimov introduced the “Three Laws of Robotics” on 1942. Nevertheless, the ambition to make machines with human being movements can be observed since antiquity – either when the Egyptians built mechanical bodies in statue shapes, or when puppets could be driven by pulley systems in Ancient Greece.

The robot control by computers became possible only on 1948, after the invention of the transistor. Six years after, George Devol applied for the first patent of an industrial robot with digitally programmable operations. The Unimate had born, and was considered the first industrial robot commercialized, after being installed at General Motors on 1961. From then on, the use of robotics has grown really fast

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