

## Particle Swarm Optimization for Optimal Process Parameters in Injection Molding

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### Abstract

Injection molding is a manufacturing process where the products or parts are made from plastic, glasses or other materials. In simple word, this process is involved with melting the required materials and injected it into the mold to produce a product or part. One of the biggest problems in manufacturing is to minimize the cost of producing a product without affecting their final product quality. To produce a high quality product using injection molding process, it is important to control efficiently the parameters involved in this manufacturing process. When one of these parameters has not been controlled efficiently, the quality of the final product can be affected. Soft computing technique can offer an option to evaluate this process efficiently at low cost before being applied by factory in creating and producing high quality product. This study focused on finding the optimal parameters' combination to produce high quality product using Particle Swarm Optimization (PSO). Based on the previous researches, PSO have been known as reliable soft computing techniques in optimization problems. The results found that PSO improved the minimum warpage value by 1.2111% compared to observed data.

Keywords: Optimization, Particle Swarm Optimization, Injection molding, Soft computing, Warpage

### 1. Introduction

The nature of market today is very competitive, in order to survive in this nature, manufacturers must produce high quality product. Without any doubt, quality has become a crucial competitive factor (Zaklouta, 2011). Product quality is the main factor in this competition, cost to manufacture this high quality product also become one of the factors involved in this competitive market nature. This statement has been introduced by Ishikawa (1982) and supported by Ryan (2011), there are four common causes lead to affect quality as shown in Fig. 1.

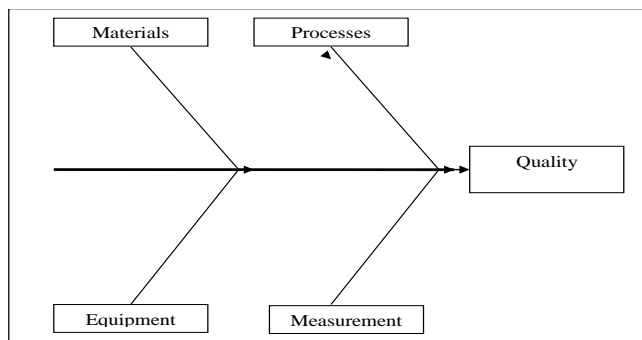


Fig. 1. : Cause-and-effect diagram (Ishikawa, 1982)

Fig. 1 shows there are four major factors affect the quality in manufacturing industry according to Ishikawa Diagram. These four factors are materials, processes, equipment and measurement.

There are many different types of industries in the manufacturing industry, which is fabricated metal industry, food and kindred industry, rubber and miscellaneous plastic industry and various other industries. Apart from a wide range of industries, manufacturing industries also have a variety of techniques to produce a variety of products, one popular technique is the injection molding.

Injection molding is a manufacturing process where the products or parts are made from plastic, glasses or other materials (Todd et al., 1994) . In simple word, this process is involved with melting the required materials and injected it into the mold to produce a product or part.

One of the main problems in manufacturing is to minimize the cost of producing a product without affecting their final product quality. To produce a high quality product using injection molding process, we have to control efficiently the parameters involved in this manufacturing process such as cooling temperature, mold temperature, injection time, Velocity/Pressure (V/P) switch over, cooling time and others. When one of these parameters has not been controlled efficiently, the quality of the final product can be affected.