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TOOL PATH GENERATION TECHNIQUE OF NC LATHE MACHINES IN FTL DEVELOPMENT BY GA

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Abstract. *In todays's global market, many large industries have put strenuous efforts to survive in ever-changing competitive market requirements. Most of the countermeasures that have been taken are through the introduction of automatic production systems such as Flexible Manufacturing Systems (FMS) and Flexible Transfer Lines (FTL) as their strategies in order to improve production efficiencies. The typical FTL is established by installing machining centers (MC) and numerical control (NC) lathe machine tools in the production lines depending on their task. It is difficult to decide the optimal tool path in the FTL development process because of its short machining cycle time. In this paper, we adopt a Genetic Algorithm (GA) approach to decide automatically the part reverse point and generate the tool path, when a workpiece is machined by NC lathe machines in FTL. The GA approach of our system adopts the moving points of the tool path as an individual. We propose two original individual expressions. The first expression is defined by adopting an absolute value of the tool path as Absolute Expression (AE) and the second expression is defined by adopting the incremental value of the tool path as Incremental Expression (IE). After some simulations, a better machining efficiency for a cylindrical type of workpiece obtained using this machining process was acquired. It could be ascertained that our system is useful.*
Keywords: NC, Lathe machine, Flexible transfer line, Genetic algorithm

1. **Introduction.** In today's manufacturing environments, many large industries have attempted to introduce Flexible Transfer Lines (FTL) as their strategy to meet competitive market requirements. In order to ensure the quality of machining products and to increase machining effectiveness, it is very important to select the tool path when the numerical control (NC) lathe machine tools are used in the machining process in developing FTL. The conventional FTL is composed of several high accuracy NC machine tools with an automatic gantry loader and its effectiveness in a high volume production of automotive parts has been proved.

Generally, the FTL needs a very short machining time. For example, the NC lathe machines in FTL needs only ten seconds to machine a workpiece. In a case of machining an automotive part like a shaft with a few steps by lathe machines in FTL, it must be machined by reversing it at a reverse point. On the other hand, the machining cycle time of Flexible Manufacturing System (FMS) or Flexible Manufacturing Cell (FMC) is very long, i.e. around ten minutes or an hour. Once the workpiece is loaded to the Machining Center (MC) of FMS, the workpiece will be processed until completed. The reverse point for machining in FMS is not so important. However, during the development process of FTL, the decision of the reverse point becomes very important. This is because the