G-CODE GENERATION FOR MACHINING SPUR GEAR IN CNC MACHINES USING THE IMACHINING STRATEGY

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ABSTRACT: *In the manufacturing industry, Mastercam X5 is a widely used CNC simulation and programming suite that offers high efficiency. It can be easily integrated with the Mastercam model, providing full associativity and seamless single-window integration. The iMachining technology, which uses patented algorithms for specific operations, is a breakthrough in CNC milling tool path technology. It optimizes the tool path, reduces machining time, and minimizes tool wear. The suite enables a wide range of machining operations on various stock objects, making it flexible and versatile. The simulation process allows real-time observation of operations and ensures error-free G-code for physical operation. This paper details the procedures of machining a spur gear from stock material using Mastercam 2D iMachining technology. The simulation process generates automatic G-codes for practical use in CNC machines. Mastercam simplifies the concept, operation, and importance of using CAM software in modern-day manufacturing industries. It also enables optimization of operational steps and parameter details to save time, cost, and tool lives, improving overall efficiency.*

KEYWORDS: *Spur Gear; Machining; Mastercam X5; G-code Generation; iMachining, CNC machine*

1 INTRODUCTION

CAM (computer-aided manufacturing) is a highly efficient process of manufacturing that utilizes computer systems or software to plan, manage, and control operations in various industries. This approach is widely used in heavy and medium industries in developed and some developing countries, providing significant advantages over traditional manufacturing methods [1-4]. One of the key advantages of CAM is the ability to control CNC (computer numerical control) machines for production. CNC machines are a form of programmable automation where the process is controlled by numbers, letters, and symbols in an instruction-based program called G-code. This method enables highly precise and accurate manufacturing, making it ideal for producing small, medium to large complex, and intricate shapes [5,6]. In CAM, G-code can be written in the software or generated automatically using CAM software to design the output product. Writing G-code can be difficult and time-consuming, as it requires deep knowledge of machines. Even with this knowledge, written codes may contain errors that are challenging to identify without performing operations, leading to a trial and error approach. This is where CAM software comes into play, providing a user-friendly solution that eliminates the need to learn G-code [7].

Modern CAM software simulates operations in real-like conditions to help users find and eliminate any problems. This eliminates the need for trial and error, making it easier to achieve successful products. There are numerous CAM suites available in the market, and Mastercam is a leading CAM software that provides intelligent machining options, optimum tool path, multi-axis machining, simulation and G-code facilities. Mastercam X5 is a powerful CAM software package that is widely used in various industries. It is easy to use, and users can quickly become proficient in its use with minimal training. This software provides many powerful features that allow users to create complex parts and assemblies easily. It also offers a wide range of machining options, such as drilling, turning, milling, and more [8-10].

The focus of this paper is on the study of Mastercam X5 software and the steps to machine a spur gear along with G-code generation as an example. A spur gear is a type of gear that has straight teeth, and it is commonly used in various