nexCOBOT
Open Robots & Machines

Case Study

NexCOBOT, Dynapath, and Intel: AI-Added Tool Grinding Design for Speed and Efficiency

NexCOBOT's CNC design and manufacturing client, Dynapath, constantly faced issues in producing accurate CNC tool grinding designs.

Introduction

NexCOBOT works with Dynapath Companies, Inc., an industrial technology company that designs and produces interactive CNC controls, software, and computerized machine tools worldwide for the metalworking industry. Their unique, innovative software and CNC controls help customers maximize productivity by reducing setup time and increasing shop floor multitasking. To improve numerical efficiency and stability of the tool grinding design process, as well as to make complex tool grinding designs become possible, NexCOBOT introduced to Dynapath its ICES 675 computer-on-module, with Intel® Core™ CPU onboard and Intel's OpenVINO™ toolkit.

Inaccurate data input and numerical dispersion create challenges

In the past, Dynapath's engineers would use its self-developed TensorFlow platform on a separate computer from the CNC controller to input design parameters and perform calculations for its 5-axis CNC tool grinder. They would then transfer the design parameters to the CNC controller after calculations were complete. This took extra unnecessary time, and engineers with insufficient experience would easily input incorrect data. In addition, the problem of numerical dispersion also made it impossible to perform the grinding process in greater detail and thereby improve product fineness.

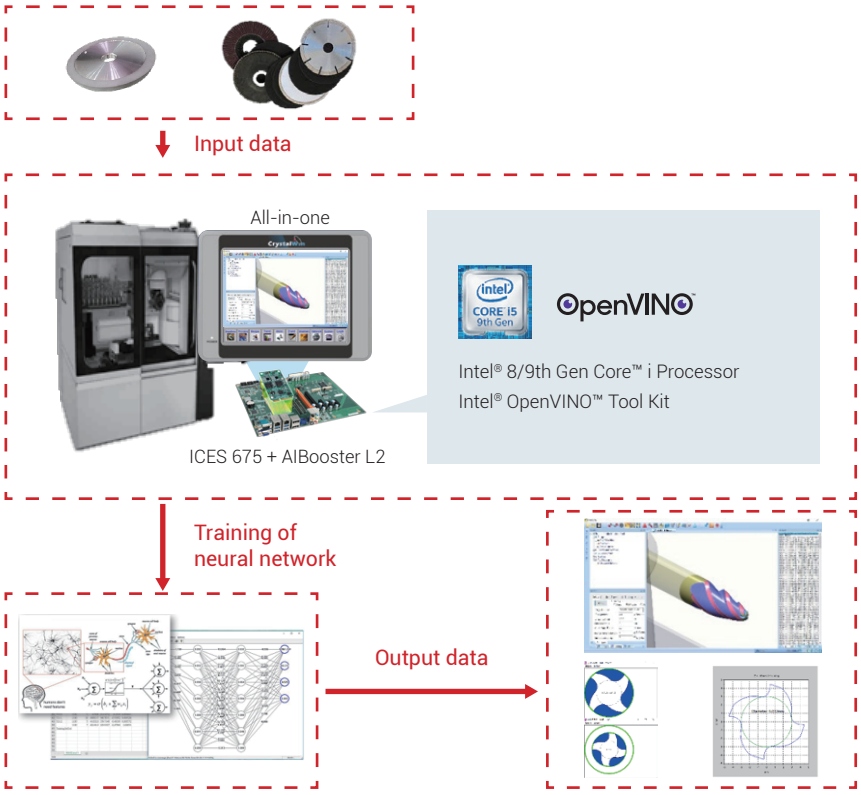

Figure 1. The addition of Intel technology to the tool grinding design system.

Integrating OpenVINO in the design process allowed Dynapath's developers to save time and increase precision.

Design problems complicate matters

To begin with, engineers needed to build a mathematical model that described the relationship between the grinder wheel geometry and its position. In order to perform numerical iterations of this model, they would take flute specifications, such as the helical angle, rake angle, diameter, and small-core diameter, as inputs. The goal was to find the grinder wheel position settings that would produce the desired profile.

It became a time consuming task to solve the numerical problem. Tremendous computing effort was necessary to find individual grinding wheel settings, as the contouring tool was composed of tens to hundreds of different radical cross sections. It was also hard to migrate to a machine controller without suitable acceleration tools like AI.

Solution: integrate OpenVINO in the CNC controller

NexCOBOT presented OpenVINO, Intel's free toolkit that developers could use to develop and deploy deep learning inference models onto hardware. As grinder wheels deteriorated, they could input new parameters into OpenVINO on the CNC controller to reduce computation time.

This created numerous benefits. First, developers saved a great deal of time, as they were able to perform calculations and adjustments quickly and correctly. They also eliminated the extra step of transferring data from a second computer as they were able to directly perform calculations on the controller. Finally, the operator could operate and update the cutting process directly on the CNC control panel, effectively increase the grinding tools' fineness.

In a complete overhaul of Dynapath's CNC controller system, NexCOBOT also upgraded the system's Intel Atom® processor to a higher-performance 8th Generation Core™ i5 with its ICES 675 COM. The addition of OpenVINO sped up deep learning inferencing to perform complex calculations and modeling.

Results: faster speeds and greater efficiency

With the combined Core™ i5 and OpenVINO AI-accelerated computing solution, NexCOBOT drastically improved the speed and efficiency of the tool grinding design process and solved the numerical dispersion problem. NexCOBOT was able to create a fine diameter precision tool grinding design (2.0–1.0 mm) and high variation profile precision tool grinding design (increasing the tool diameter variation ratio from 4 to above 10). This integration shows the incredible benefits of using AI: first, in dealing with issues of product specification changes, grinding wheel deterioration, and machine adjustments; and, secondly, to improve the numerical efficiency and stability of the tool grinding design process so that online, complex tool grinding designs become possible.

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