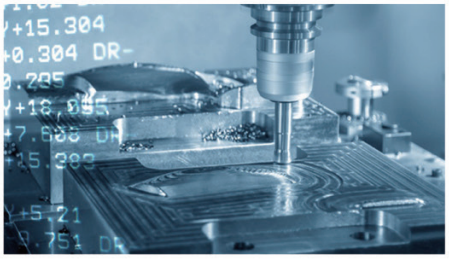


USE CASE

ADLINK's Velocity Planning Solution Maintains Motor Stability During Laser Beam Machining

In addition to common processes such as laser cutting, welding, and deburring, contouring is widely used in CNC systems for various industrial automation applications.

As the aesthetic qualities of product designs improve and computer graphics become increasingly complex, conventional laser beam machining (LBM) processes can be inadequate for achieving desired outcomes under short deadlines and without unnecessary complications. The motors involved in LBM typically accelerate and decelerate rapidly during contouring, making it difficult to maintain stability due to strong vibration.



No more stops and starts

With over 20 years in motion control, ADLINK provides solutions for markets with high standards for precision and reliability (e.g., the military). To address the stability issues encountered during contouring, ADLINK developed a built-in, easy-to-implement velocity planning algorithm. By determining maximum velocity, acceleration, and the corner velocity limit during corner turning, the motor can remain stable during contouring without complicated command settings.

Velocity planning makes it possible to speed up the contouring process while keeping the motor stable. The following figure shows that before velocity planning, the velocity and acceleration/deceleration of the motor vary between each command; all final and initial speeds are 0, indicating that the motor stops and starts repeatedly during contouring. After velocity planning, the number of accelerations between each command drops to 0, indicating that the motor is stable.



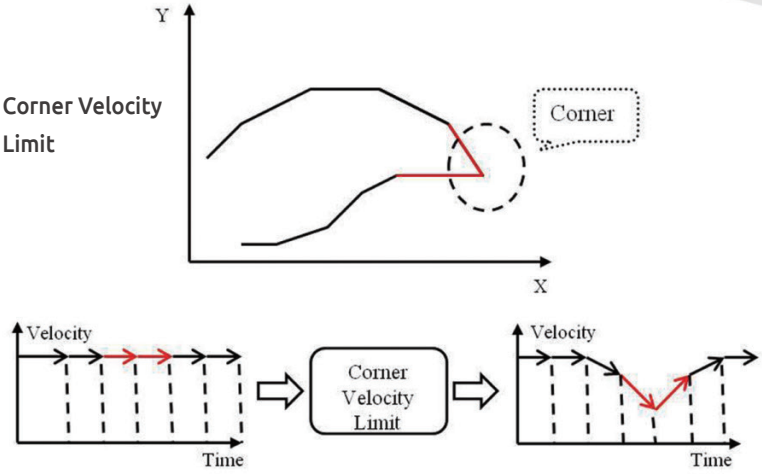
Corner turning is also common during contouring. To reduce the inertia of the motor as it turns, ADLINK's velocity planning solution limits corner velocity and reduces the velocity of the motor before it starts turning. The formula for determining corner velocity is as follows:

$$V_{corner} \leq V_{max} \cdot exp\ (-a\theta/1000000)$$

Where Vcorner is the corner velocity, Vmax is the maximum velocity during contouring (input manually), α is the limiting parameter of the input corner velocity, and θ is the corner angle. This formula can be used to obtain the corner velocity limit during corner turning. In the following figure, the red line is the "corner" of the two straight lines that occur during contouring. By limiting corner velocity, the velocity decreases before the corner section and returns to its original value shortly after.

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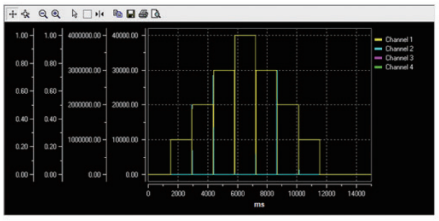
Corner Velocity Limit



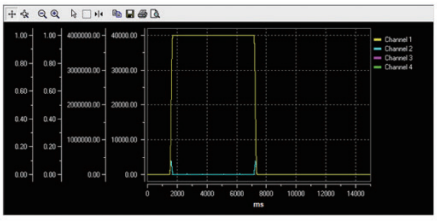
Poor velocity planning during contouring can cause machine vibration or inertia during corner turning. ADLINK's built-in velocity planning solution re-plans the contouring velocity to reduce machine vibration and maintain stability during the contouring process.

The following figure shows the velocity of a motor before and after velocity planning. As shown, after velocity planning, the motor does not decelerate to 0 and then accelerate again after each command. That is, the motor no longer stops and starts rapidly. Additionally, after implementing velocity planning, the overall contouring operation time drops from 9.2 seconds to 5.8 seconds.

Yellow: Velocity
Blue: Acceleration

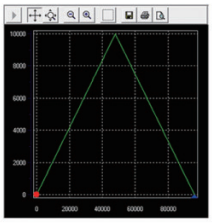


Before velocity planning

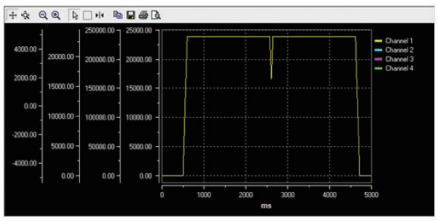


After velocity planning

The following figures depict the corner path without a corner velocity limit (left) and the velocity curve with a corner velocity limit (right). When the corner velocity limit is applied, the velocity decreases before corner turning and then returns to normal shortly after.



Corner path without corner velocity limit



Corner path with corner velocity limit

Advantages

ADLINK's built-in velocity planning algorithm provides the following benefits:

- ***Saves effort and time:*** Instead of setting the velocity curve for each command, only the maximum velocity and acceleration need to be set.
- ***Maintains stability:*** By applying a corner velocity limit, velocity can be reduced before turning to maintain motor stability.

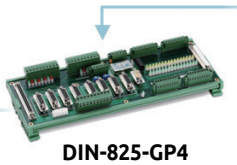
AMP-204/8-C and PCI-8254/8 are high-performance, high-accuracy centralized motion controllers that provide comprehensive application functions, and along with ADLINK's MotionCreatorPro 2 utility, can reduce development time and costs by up to 25% while maintaining superior throughput and accuracy and a 10% growth rate.

These controllers also support the ADLINK APS function library, further reducing development time and expediting implementation. The APS function library leverages ADLINK's 20+ years of experience in machine automation and features a wide range of general, advanced, and application-ready motion functions to help developers dramatically reduce development time and limit costs in order to lower the technical threshold of manufacturing automation applications.

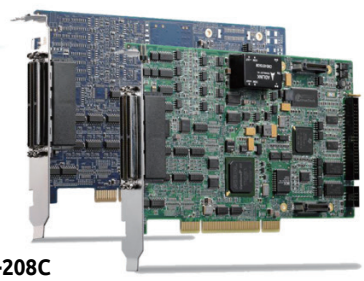
Learn more about ADLINK's motion controller solutions:
https://www.adlinktech.com/tw/Motion_Control

Laser Beam Machining





DIN-825-GP4



AMP-208C

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