Malz++Kassner
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Automated Guided Vehicle Systems Call For Complicated Route Calculations

Staying On Track In Spite Of No Driver: Götting KG Is Planning Lines for Autonomous Vehicles From Curve Radius To Speed Using Special CAD Software

Automated guided vehicle (AGV) systems take workpieces from one machine to the next machine or convey entire truck loads between different factory buildings. They handle recurring logistic processes in an automated fashion and thus remain more flexible than rail vehicles. Navigation and guidance of separate transporters are decisive for the smooth flow. Götting KG, one of the market leaders in wireless data communication and guidance technologies for automated guided vehicles, has developed its own add-on to the CAD6 Studio design program in collaboration with the IT specialists Malz++Kassner. Now vehicle movements including tractrix curves can be simulated based on a predefined track. At the same time, the software may also be used for designing components: Thanks to a guideline function, it is possible to construct complex geometries in a simple manner.

A tractor trailer leaves the loading ramp and starts to travel across the company's premises without a driver sitting behind the steering wheel. What sounds like science fiction has long been reality in many factories. Automated guided vehicles like fork lifts, freight platforms with own transmission or trucks are used to move goods from point A to B wherever rail vehicles or conveyor lines are too expensive, too complicated or too inflexible.

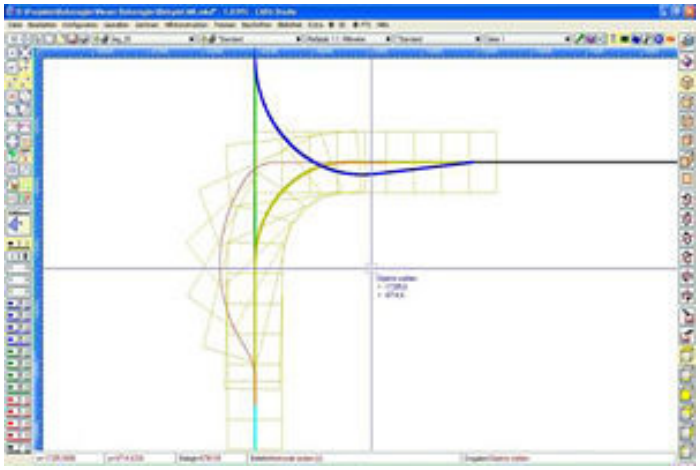
Götting KG is the leader in this segment: Companies ranging from adhesive manufacturers to car makers have already integrated Götting KG's guidance technologies in their processes. The engineers utilize, depending on the requirements, different systems such as guide wires, optical markers or GPS navigation systems.

One popular solution also includes transponders. “These offer the advantage that entire routes do not have to be outlined. Instead it is only necessary to drill a few holes,” explains Matthias Götting of Götting KG. “In addition to that, the transponders work regardless of weather conditions and surface conditions. The vehicle does not deviate from its course even in case of an extremely dirty roadway.” As a result, the automated guided vehicles can be used even in dock areas.

CAD Program Extended With Path Simulation

Calculating and defining paths for transponder systems pose extremely high demands on planners. “The problem with that is that the edges of a vehicle do not correspond with its lane. Vehicles also do not follow the exact same path. That's why it is not possible to say in general

that a three-meter-wide track is sufficient for a truck which is 2.55 meters wide," Götting explains. Consequently, a separate simulation application was needed for determining tracks. The design software CAD6 from Malz++Kassner GmbH, which has been used at Götting for years, served as a basis. "It was important to us that the program is user-friendly and easy-to-use, since we make the application available to customers as well," says Götting. "In addition, the software can be set to a wide variety of languages, making it ideal for handling international projects too."



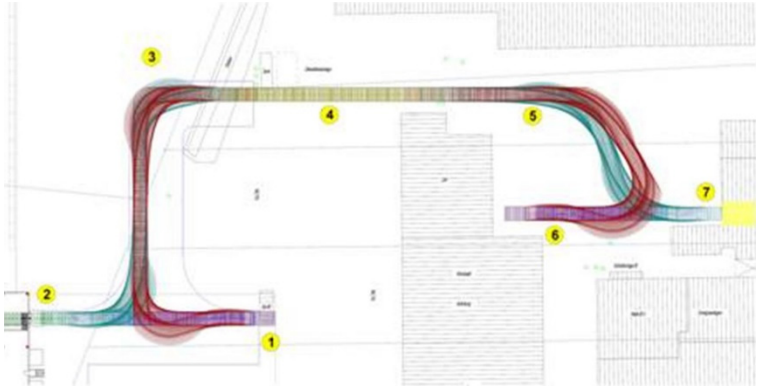
A decisive criterion was, however, that the program has open interfaces, which allow for implementing add-ons.

As a result, the FTS specialists of Götting KG developed the calculation criteria for defining paths and then had Malz++Kassner transform that into a plug-in. This module is used to create, edit and export trajectories, which can be processed by the vehicle's controllers. The hall and ground plans form the basis for this, explains Stefan Malz, one of the managing directors at Malz++Kassner. "Plans in CAD formats DXF or DWG can be imported directly and edited. Scanned paper plans, which are not available in these formats, can be inserted as background for orientation purposes." In addition, the exact parameters of the vehicle to be used later on must be entered, such as type, dimensions, center distance, steering angle and similar. When the path is drawn as a thin trajectory in the plan, the program calculates the actual dimensions of the path based on these parameters. In doing so, the program simulates the vehicle traveling along the path in order to identify any bottlenecks and critical points.

Developing Trajectories With Feasible Turning Radii And Speeds

Curves, backing-up maneuvers and towing operations are calculation-intensive, since the axles behind the steering axis move off the path and thus the vehicle covers a larger area. The rear wheels follow a so-called tractrix curve, where the exact space requirement of the curve radius, vehicle length, axle length and number of axles as well as the structure of the vehicle is defined. The tighter the curve and the longer the means of transport, the greater the area that must be kept free for curved track movements. The front outer corner of the vehicle determines the outer edge of the area required, while the back inner corner marks the inner boundary. A trailer follows the tractor truck further inwards in the turn.

That's why the contour of the path is generated several times in the CAD program, virtually travelled, improved and then simulated again in order to get the ideal path for practical operations.



The final dimensions of the path are determined using the vehicle's parameters. “By ensuring that the trajectory takes these parameters into account and that the curve radii and steering speeds are selected accordingly, it is possible to make sure that the vehicle can manage all curves as well,” states the software developer Malz. In doing so, the travel path of a trailer is also taken into account for instance. The final path is made up by a number of nodes.
Based on this, the program calculates the amount of control points that define the path. Acceleration, speeds, and stops are also entered in the path drawing via CAD6 using the plug-in. Control points and speeds are finally realized in a transponder controller, with the aid of which the vehicle navigates from node to node and thus checks the respective position and speed.

Guideline System As Basis For Complex Design Drawings

Besides this special application, CAD6 is also used at Götting KG for conventional design tasks. “We produce several mechanical parts on our own, for instance, enclosures. We can easily design these with the software and provide the necessary data for production,” Götting reports. “To this end, the program offers the very useful option of using auxiliary constructions.”

These guidelines are a particular feature of the CAD software from Malz++Kassner and allow the user to derive complex geometries from simple forms and constants. For instance, the program calculates on demand the medians or bisectors of a rectangle, allowing the user to determine the exact middle point. With the integrated capture function, the intersections and corner points of these guidelines can be directly used as starting points for a further drawing. Individual line and curve sections can easily be included in the actual design with the aid of simple menu options to create cut-outs or angles. Malz explains the idea behind this uncommon assistance as follows: “The program is based on actual tasks used on a drawing board, which makes use and designing easier and more intuitive.”

(for more information online, go to: www.goetting.de, www.cad6.com)

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Götting KG was founded in 1965. It specializes in the development of wireless data communication systems and sensors for automatic track guidance of automated guided vehicles (AGV). The company's portfolio in this segment is one of the most comprehensive in the world. Götting KG produces transponder positioning systems with an accuracy of up to ±1 mm, optical sensor systems, laser scanners or inductive wire guidance systems, GPS navigation systems and other things. In addition, Götting KG develops solutions for track guidance systems with contactless energy transmission and obstacle recognition systems. Other business areas include HF measuring technology, general radio technology and customer-specific developments. Götting KG was distinguished with the VDI Innovation Award for Logistics in 2002, the European Transport Award in 2002 and the Trophée de la Biennale Européenne de la Logistique in 2003. The company has about 45 employees, whereas 15 are primarily involved in development.

Malz++Kassner GmbH was founded by Stefan Malz and Olaf Kassner in 1997 as a private partnership. Both of the company's founders are involved in the development of graphical and CAD software and have created, among other programs, WINCAD, one of the first CAD programs for Windows, since 1985. Their software CAD6 has established itself as one of the industry standards to date and is available with different specifications for different users – from industrial users and graphic designers to private model makers. Thanks to its open interface, CAD6 can easily be adapted to individual requirements. There are diverse libraries and plug-ins available for such purposes. The company's clients include Hydraulika, ADtranz, Bombardier and Westpfalz-Klinikum, to name just a few. A special version of CAD6 was prepared for the ISS visit by German astronaut Thomas Reiter on behalf of the European Space Agency.

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