



# Machine tools with a sense of touch

**TRUMPF brings new sensors from science to the machine with Novicos**

*The year is 2022 - a year in which machines will be able to make decisions so autonomously that our neighboring planets will become popular destinations for research trips. German high-tech company TRUMPF, market leader in machine tools for flexible sheet metal processing and industrial lasers, is also working at the cutting edge of automation. The German company is developing a new sensor system that will enable laser cutting machines to make even more intelligent and autonomous decisions.*

The flying altitude of scientific methodology provides sufficient foresight to fully grasp new technologies and also to recognize special cases that need to be investigated. This is why TRUMPF is cooperating with the science-based development company Novicos GmbH in the field of sensor technology.

What is the gentlest way to detect signs of life in people and machines? Put your hand on it. The tactile sensors in our fingertips are capable of detecting and analyzing the slightest vibrations. Development engineers at TRUMPF have used their knowledge of the versatility of the sense of touch to pursue a bold plan: the team led by Armin Többen, M.Sc., is working on a new technology in which laser cutting machines use vibrations to independently check whether the cut material has been completely removed from the scrap skeleton. The machines then decide autonomously which steps to take next in processing the workpiece. The high degree of automation and digitalization distinguishes TRUMPF machines in the sheet metal processing market and supports TRUMPF customers in their digital progress.

## To the Point

- Together with Novicos, TRUMPF has developed a new method to check whether the cut material has been completely removed from the scrap skeleton.
- The process applies an artificial vibration to the scrap skeleton and measures whether the cut material vibrates with it.
- The solution was developed in the laboratory and validated on the machine tool.
- The final product automatically analyses the measurement data and gives clear instructions to the machine.

## Contact testing by vibration

The idea is to apply an artificial vibration to the residual network and then check whether the vibration is transmitted to the component. Only if the component remains still does it no longer have a connection to the residual grid. „The elegance of this measurement method lies in its gentleness, which allows us to test even the most sensitive surfaces without hesitation. The flexibility of the principle is also exciting. For example, it can also be used on materials that are not electrically conductive,“ says Többen, describing his team’s achievement.

In the field of acoustics, however, their development in the field of acoustics isn’t just an everyday task. „The interrelationships in vibration technology are highly complex and a challenge even for highly trained development engineers,“ admits Többen. A high scientific standard is required to fully penetrate such a topic. We have found this at Novicos.

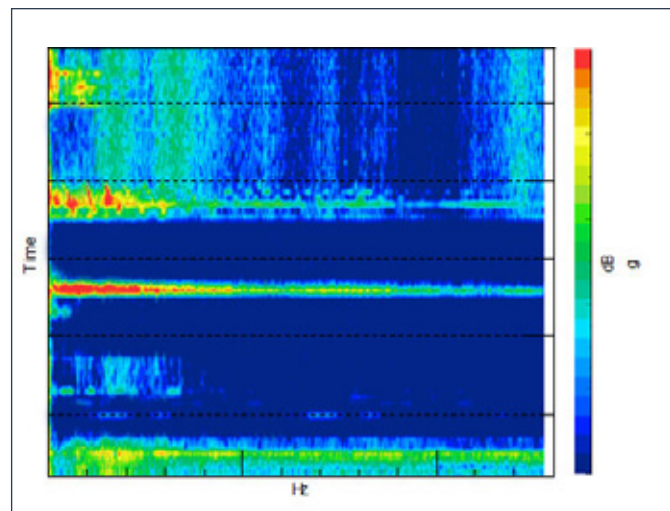
## From science to the street

Novicos was therefore commissioned by TRUMPF to take their idea to the heights of scientific methodology – and land safely back in practice. Dr Sören Keuchel, Managing Director of Novicos, took on the project personally and set to work with his team of PhD engineers. „We were excited by the idea, but at the same time we knew we had to find answers to questions that hadn’t even been asked yet“.

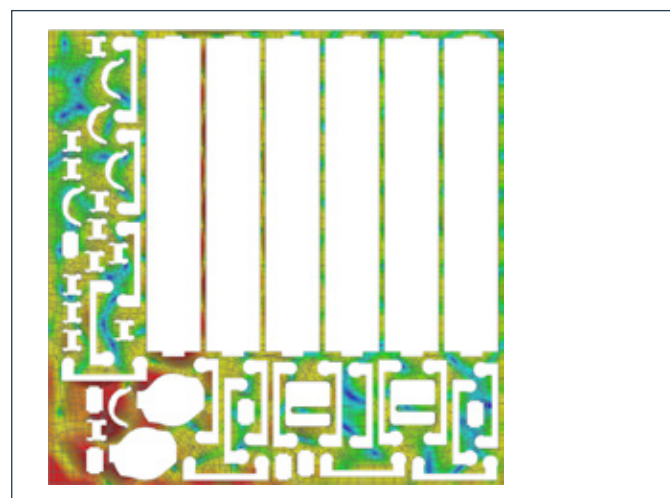
The seemingly simple question of the right sensor and actuator is preceded by hundreds of questions. What does a signal have to look like to give reliable results in a wide range of situations? How do the material, the cutting situation and the position of the sensors affect the measurement results? What kind of spurious signals can occur and how can they be distinguished from the desired vibrations? However, if you get stuck in the weightlessness of the laboratory, all your results will remain in orbit and you will not be able to bring your findings to the road as a real innovation. This is where Keuchel sees his vocation: „We are pilots who can fly circles at the top, but then bring the innovation directly into the machine.“

They also maintained their composure under the challenging conditions of the TRUMPF project: first they formulated scientific questions and found abstract answers in the laboratory. Then the measurement results were validated on the real machine. The result was a meeting at which Keuchel presented exactly the answers TRUMPF needed to move the project forward: The actuator, the sensors and the correlations that had to be taken into account during the measurement. „Good landing!“ agrees Többen: „Novicos demonstrated a scientific and methodical approach at institute level in their investigation. That’s why we chose them. What impressed me was the level of thought that went into translating the scientific results into clear instructions for practical use.“

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Spectrogram of Acceleration



FRF Simulation for Machining Conditions



### Patents in series production

While the new findings on „residual grid separation sensors“ have already found their way into one of TRUMPF's many patents, the road to series production continues. The final product will be able to intelligently analyze measurement data and give clear instructions to the machine. Többen smiles confidently: „Thanks to the excellent cooperation on this project, I can well imagine that TRUMPF will continue to work with Novicos in the field of sensor technology.“ Keuchel is also pleased, because his team is already preparing the weather conditions for the next launch.

*... » I am impressed by Novicos' ability to translate the results from the scientific flight level into clear instructions for practical use « ...*

Shuttle at the Machine Tool

