Tooling News No.564

SUMITOMO
CARBIDE - CBN - DIAMOND
Global Support, Global Solutions.

Tooling Support Plus

Sensing tool **SumiForce**

Adding DX (digital transformation) to KKD (kan, keiken, dokyo: intuition, experience, and nerve) Visualizing cutting with sensing tool SumiForce

SumiForce

Together with our customers: Sumitomo Electric Hardmetal craftsmanship

SUMITOMO ELECTRIC GROUP

Setting conditions based on quantitative values, helping identify error causes through visualization

Sensing Tools for Milling

Equipped with sensor, battery, and wireless device

Sensing Tools for Turning

Measures cutting edge status with sensor

Transmits wirelessly and analyses data

- Conditions set upon production line startup based on quantitative values
- Error cause identification through visualization if problems occur

KKDX machining support process

1 Advance investigation, checking whether measurement is possible

- Measurement content investigation, checking tool used, checking measurement location
- Checking interference, checking installation location
- Estimate (subsequently)

2 Sensing tool installation (approx. 10 minutes)

- Tool installation, receiver installation, PC installation
- Checking interference, checking radio wave status, checking operation

3 Measurement work

- Measurement by our staff
- Additional measurement upon request

4 Analysis results report (approx. 1 week)

- Measurement/analysis results provided as a report

5 Cutting conditions optimization and suitable tools recommended

- Support for customer cutting conditions selection provided
- Suitable tools recommended

Lineup of Sensing Tools for Turning

https://www.sumitool.com/en/aboutus/assets/pdf/kkdx_01.pdf

Lineup of Sensing Tools for Milling

https://www.sumitool.com/en/aboutus/assets/pdf/kkdx_02.pdf

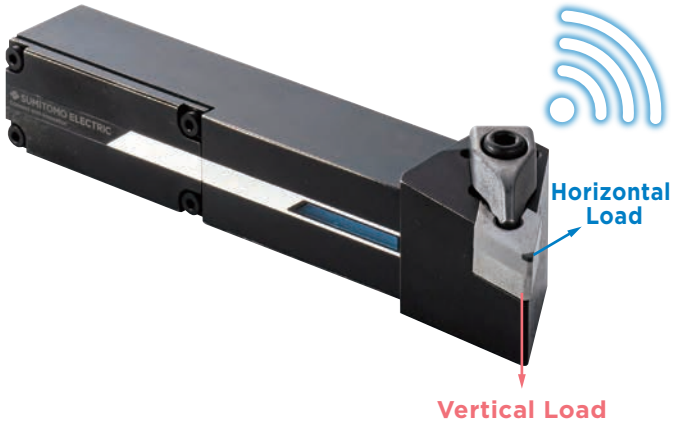
Have you ever had this problem?

[Machining method selection]

1. Startup, early mass production
   It takes too long to decide on cutting conditions and cutting paths based on noise and machine vibration during cutting.
2. Mass production
   Machining efficiency suffers from cutting errors with unknown causes.

Our staff offer support solving customer problems through measurement and analysis.

Directly mounted on the turret, wireless communication renders in-machine wiring unnecessary

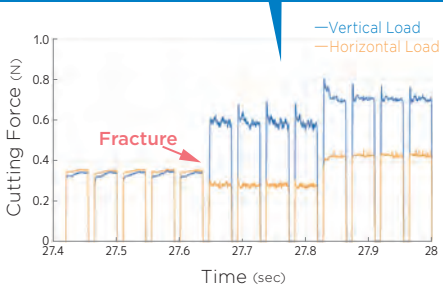


Vertical Load ≈ Principal Force
Horizontal Load ≈ Feed Force plus Back Force

1. High-sensitivity measurement of minute changes
2. Measurement of vertical load and horizontal load
3. Same size as 25mm square holder
4. 99% the rigidity of normal holders

■ Tool Fracture

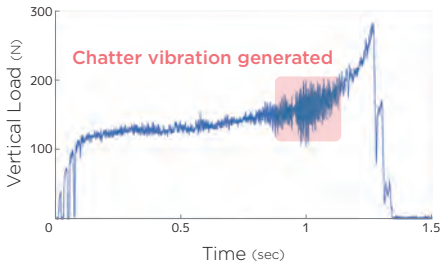
Low vibration and clear waveforms even in interrupted machining



Size	25mm square (25 x 25 x 150)
Sensor method	Semiconductor Strain Sensor
Measurement range	Approx. ±4,000N
Measurement direction	Vertical/Horizontal
Sampling rate	1,944Hz (changeable under specific conditions)
Communication standard	Bluetooth® LE
Communication distance	Approx. 5m (depending on surrounding environment)
Power supply	Battery type, 225 continuous hours
Usable temperature	Approx. 70℃ (sensor part temperature)
Others	32mm square can be manufactured; consult our company concerning 20mm square and smaller

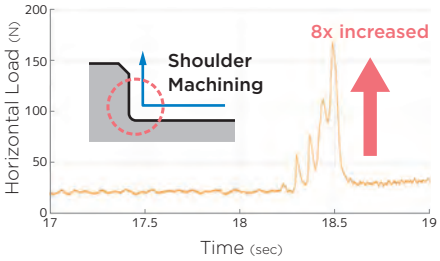
■ Chatter Vibration

Small **chatter vibration** hard to pick up on site can be grasped



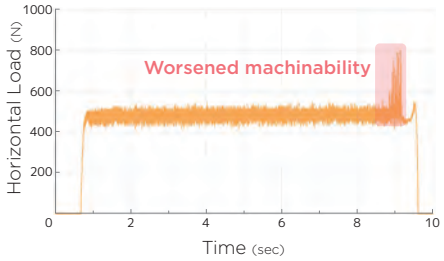
■ Bottleneck Processes

Bottleneck processes likely to lead to fracture or shape defects can be grasped



■ Machinability

Machinability, the cause of notch adhesion, can be grasped



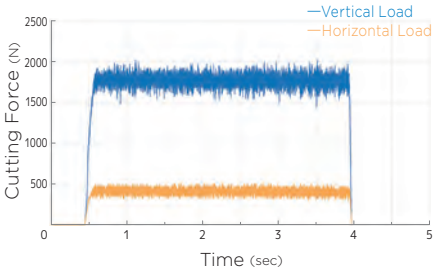
■ Chip Biting

Chip biting, the cause of fracture and worsened surface roughness, can be grasped

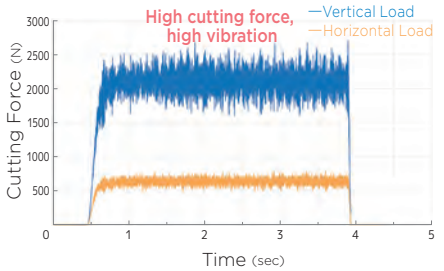
■ Suitable Tools

Machining quality fluctuations caused by different tools can be grasped

Suitable tool

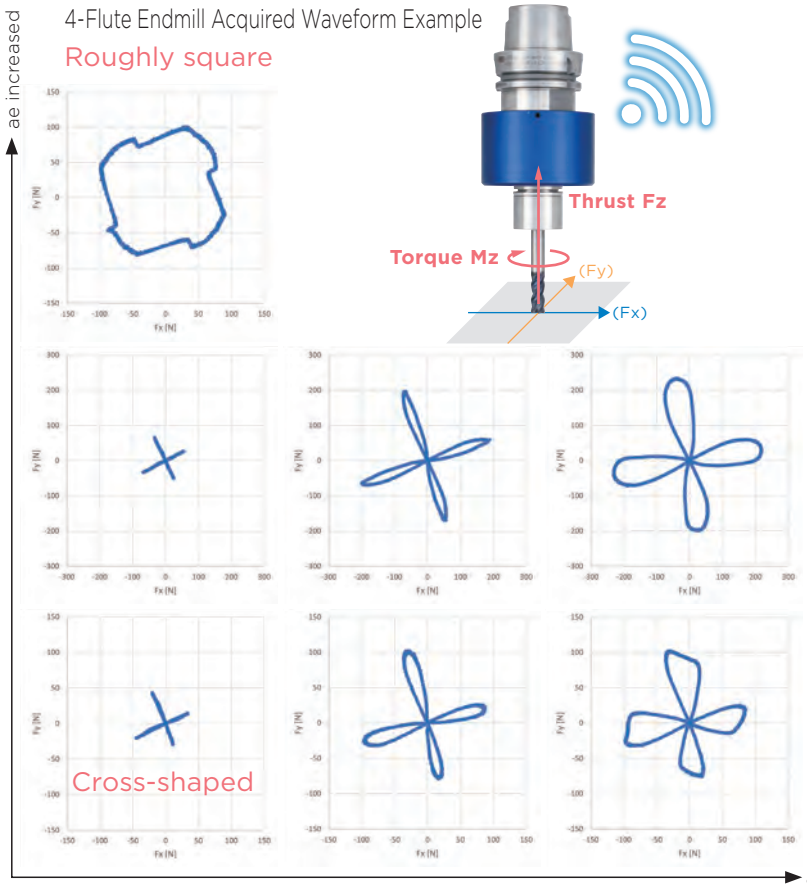


Unsuitable tool



Sensing Tools for Milling

Directly mounted on the machining center spindle, wireless communication renders in-machine wiring unnecessary



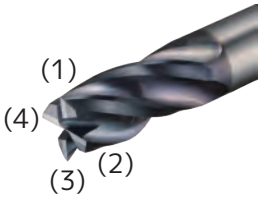
More detailed machining status is visible from changes in the tool coordinate system XY surface cutting load

1. High-sensitivity measurement of minute changes
2. Load measurement of tool coordinate system XY surface in addition to thrust and torque
3. Unique integrated holder structure
4. ATC support also possible

External dimensions	ø80 to 100 (length depends on Cat. No.)
Sensor method	Semiconductor Strain Sensor
Measurement range	Depends on Cat. No.
Measurement direction	Tool coordinate system Fx, Fy, Fz, Mz
Sampling rate	2kHz (changeable under specific conditions)
Communication standard	Bluetooth® LE
Communication distance	Approx. 5m (depending on surrounding environment)
Power supply	Charging type (Ni-H), 24 continuous hours, 80 minutes charging
Usable temperature	Approx. 70℃ (sensor part temperature)
Maximum spindle speed	12,000 min^{-1}

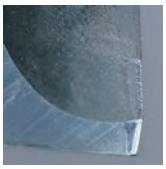
■ Groove Milling

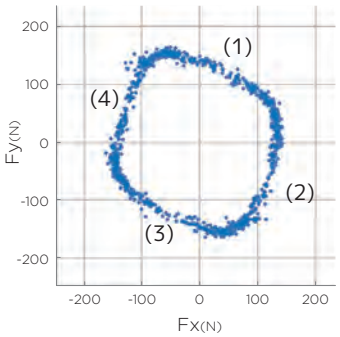
Status of each cutting edge is visible



○ Normal machining

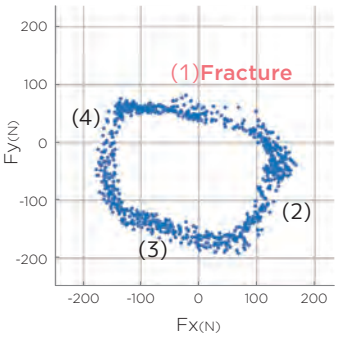
Roughly uniform machining for 4 flutes





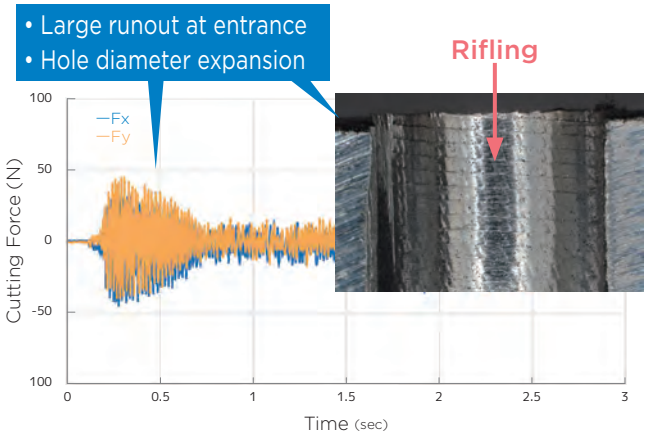
× (1) flute is fractured

(1) flute allowance is reduced, Fx-Fy shape is changing

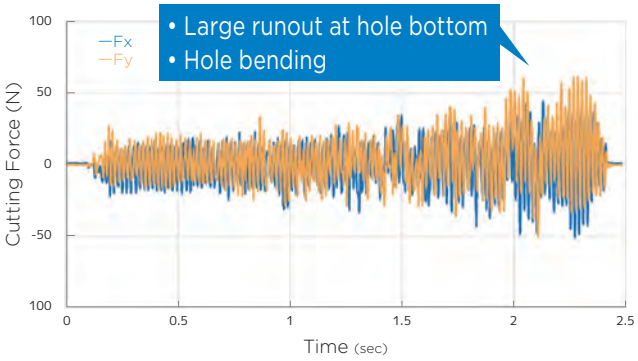


■ Drilling

Changes in cutting force on XY plane visualize hole diameter expansion and hole bending, not visible from spindle current values



Suitable Drill Selection
Optimization of Cutting Conditions



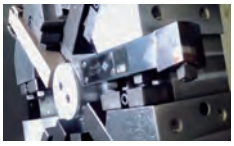
Example of Improvement with KKDX Machining Support

Location of activity

Customer actual machine

Our company evaluation center

- Hokkaido Tool Engineering Center
- Tohoku Tool Engineering Center
- Yokohama Tool Engineering Center
- Tokai Tool Engineering Center
- Itami Tool Engineering Center
- Kyushu Tool Engineering Center



Conventional process

Cutting Conditions	Cutting Phenomenon	Results
● Cutting Conditions	● Cutting Force	● Shape
● Tool Path	● Cutting Heat	● Cycle Time
● Tools	● Chatter Vibration	● Tool Life

→ OK

NG

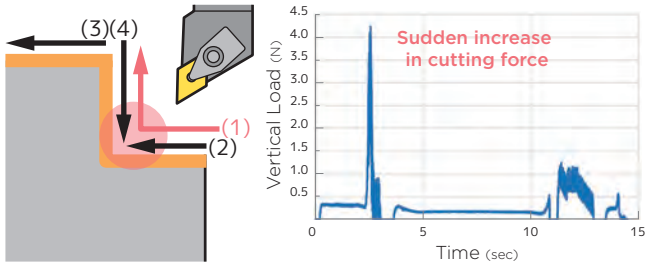
Deciding on conditions through trial and error takes a long time

Process with sensing tools

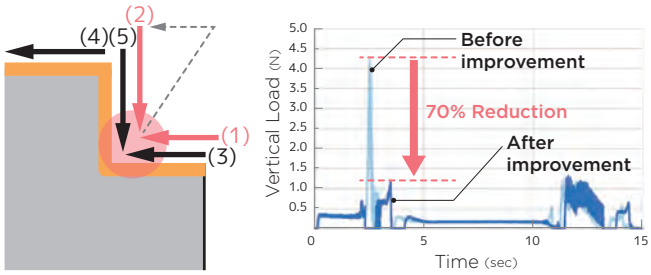
Visualizing cutting phenomena with sensing tools ▶ Visualized effects of improved machining paths

Identifying tool life issues in turning

■ **Before Improvement**: Sudden increase in load at shoulder

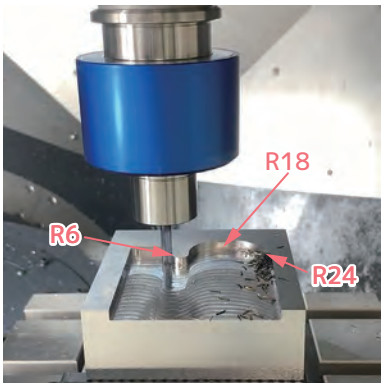


■ **After Improvement**: Load suppressed due to improved path



Tool life improved by changing machining paths in bottleneck processes with high cutting force

Identifying breakage causes in milling



Machining in order of R24, R18, R6

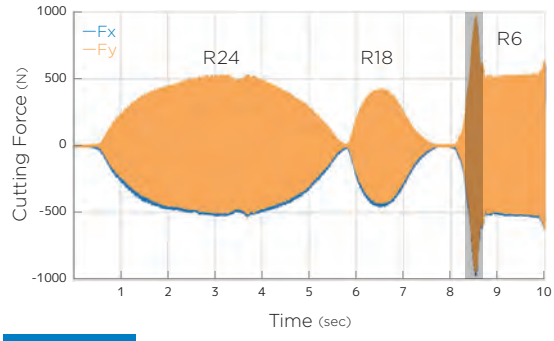
Predicting vibration is difficult with simulation software

▼

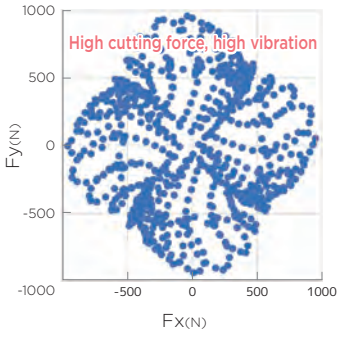
Actual measurement covers cutting force and vibration as well

Before improvement

Numerous breakages when machining R6 part

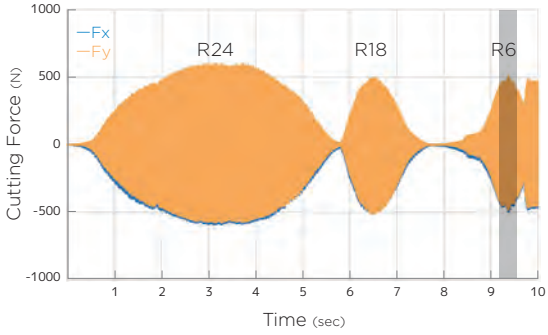


Fx-Fy plot of R6 part

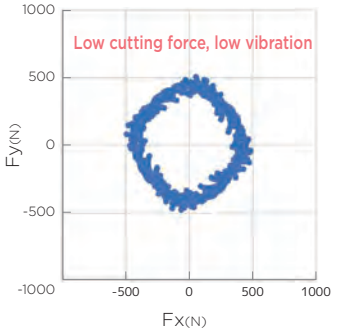


After improvement

Reduced feed conditions for R6 part



Fx-Fy plot of R6 part



Tool breakages minimised by reducing feed conditions at high-cutting force R6 part

MEMO

MEMO

< SAFETY NOTES >

- Very hot or lengthy chips may be discharged while the machine is in operation. Therefore, machine guards, safety goggles or other protective covers must be used. Fire safety precautions must also be considered.
- Please handle with care as this product has sharp edges.
- Improper cutting conditions or mis-handling of the tool may result in breakages or projectiles. Therefore, please use the tool within its recommended conditions.
- When using non-water soluble cutting oil, precautions against fire must be taken and please ensure that a fire extinguisher is placed near the machine.

Sumitomo Electric Industries, Ltd.

Hardmetal Division

Global Marketing Department : 1-1-1, Koyakita, Itami, Hyogo 664-0016, Japan

https://www.sumitool.com/global

(2025.10)I SN/AK