Turning your world

APPLICATIONS
BALANCED CUTTING

INTRODUCTION

Balanced cutting is the process of **simultaneously machining with two turret**,. The principle of this operation is based on **balancing the machining forces** of each tower.

When machining with a **single turret**, the machining force acts as a lever on the part and creates vibrations. However, when **two turret**, machine at the same time, the machining forces are cancelled out, allowing vibrations to be reduced and **increasing the overhand** of the part.

Balanced cutting can be applied to both milling and turning. In the case of turning, feed rate can be increased by up to double.

This application of CNC lathes is highly useful in parts such as **shafts or slender geometries**. In the case of CMZ, the costumers who use this process most are those who come from the automotive or equipment goods sectors. An example of balanced cutting is roughing and semi-finishing of short shafts for gearboxes for forklift trucks.

Balanced cutting can be done with the CMZs TX series of lathes, both Y2 (2 turret) and Y3 (3 turret).

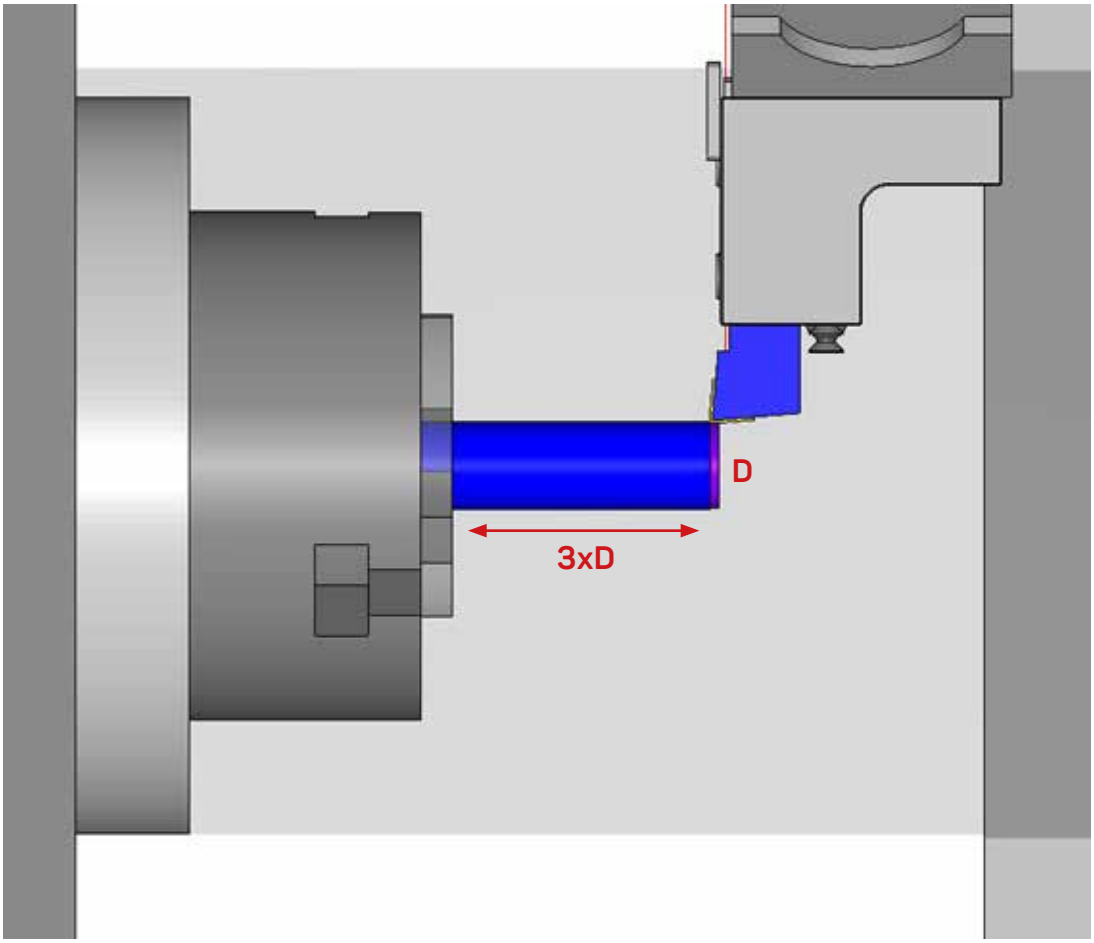
BALANCED CUTTING

Discover how to machine with larger overhangs thanks to the balance cutting. The use of two tools compensates the cutting forces allowing you to machine further away from the chuck. This application is available for all our multiturret lathes in TX Series..

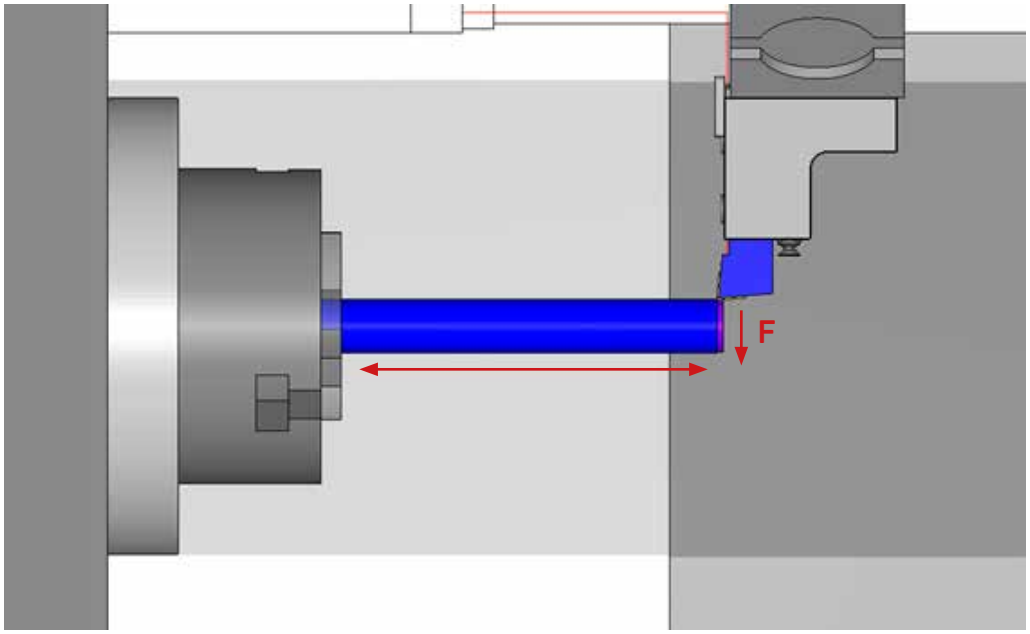
BALANCE TURNING

When machining with a single turret, recommended overhang should not be over 3-4 times the diameter of the part. If the part overhang is longer than that the force ejected by the tool will make flexion to the part causing vibration and very poor turning surface.

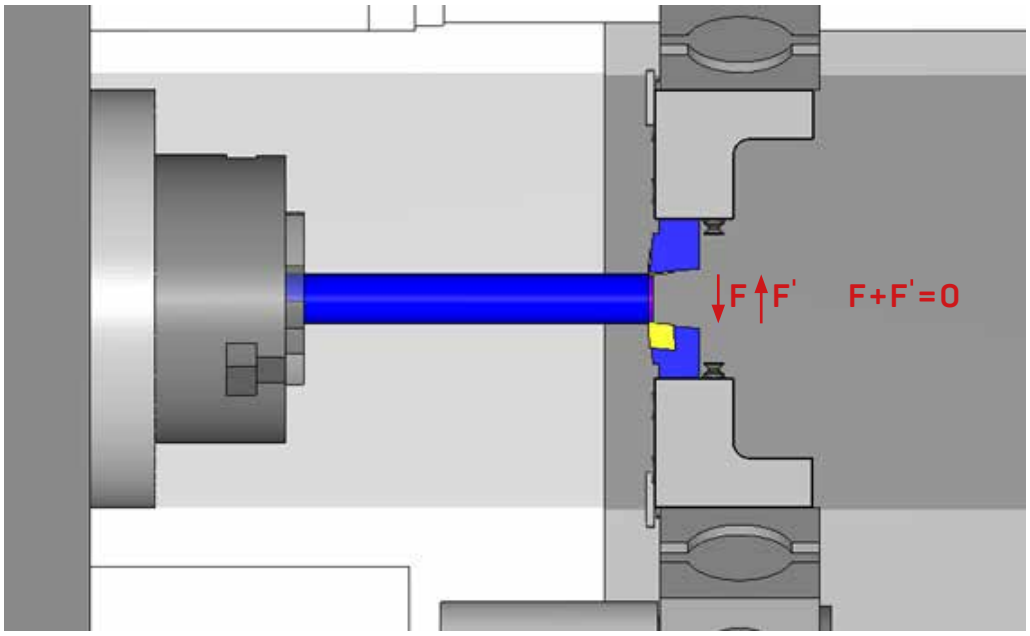
3xD OK



Over 3xD NOT OK

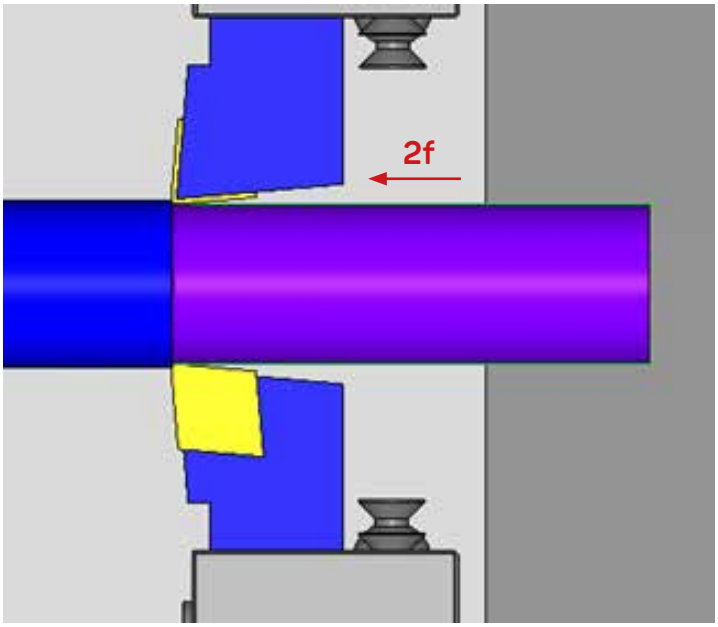


However, when two tools are used to make the same operation the forces are compensated and longer overhangs can be used.

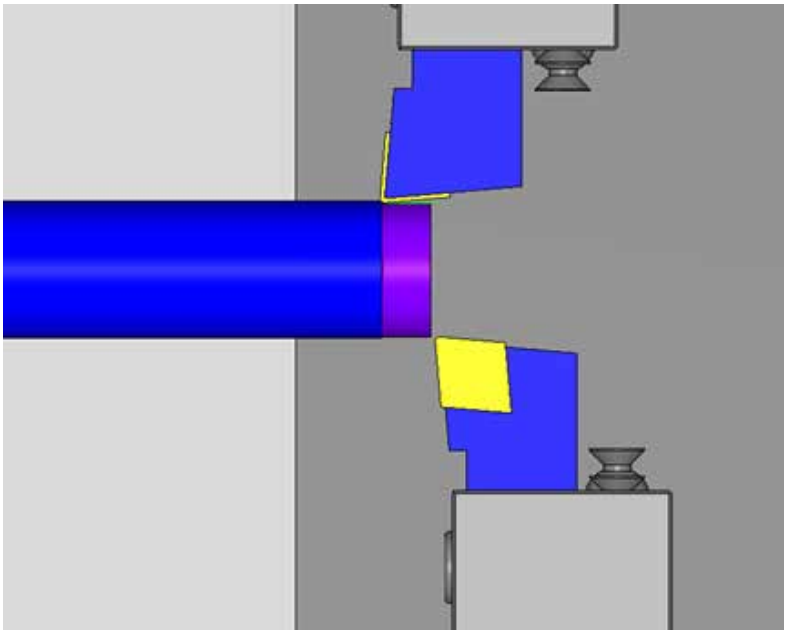


Balance cutting also has more benefits

1. If the two tools are cutting simultaneously **the cutting feed can be doubled**.

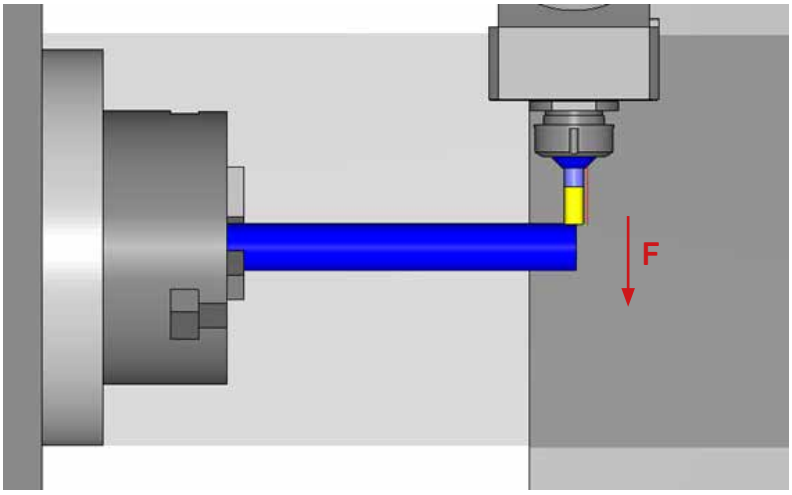


2. If a small gap is used between the two tools **one tool can rough and the other finish**.

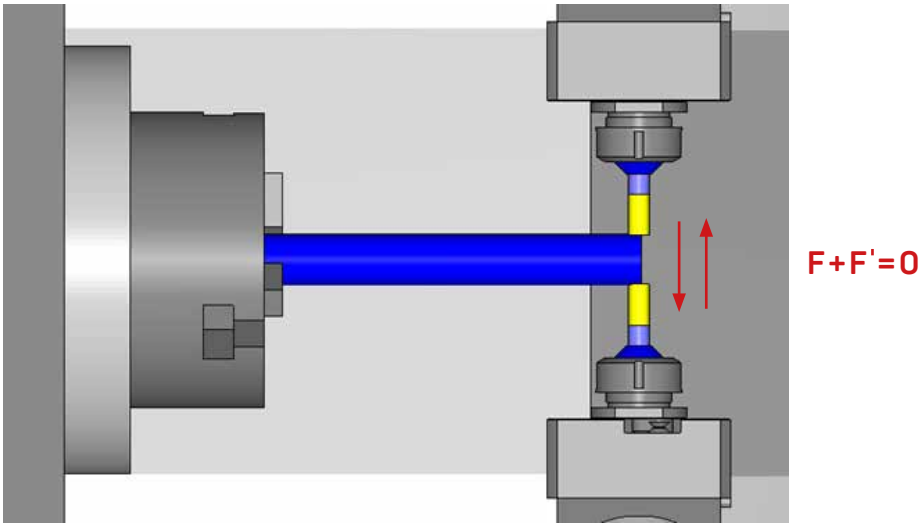


BALANCE MILLING

The idea in balance milling is the same as in turning. If the milling operation is done with a single turret away from the chuck the milling force will eject flexion force to the part and it will vibrate.



However, if two tools are used to make the same operation those flexion forces will be compensated and no vibration will happen.



It is important to mention that this process is not recommended when tight tolerances are required as it is difficult to know how much each tool is wearing, particularly in the milling case.

PROGRAMMING EXAMPLE

There are several ways to program balanced cutting. It is important to take care of the synchronisation to ensure that both turrets are cutting at the same time.

1 / BALANCE CUTTING CODE (G68/G69)

G68 activates balanced cutting

G69 deactivates balanced cutting

> **!**
>
> G68 will synchronise the start of the feed movement but the program needs to be the same in each path.

PATH L (Upper right)

```
O0001
M901P13
T101 (ROUGHING)
G50S2000
G96S200G99F0.2M3M18M403
M303
G0X30Z2
G68;
G71 U3.5 R0.5
G71 P10 Q20 U0.1 W0.1 F0.6
N10 G00 X22.3
G01 Z-27
X23
Z-132.4
X26
N20 X30
G69
G0G53X-35Z250Y0
```

PATH D (Lower turret)

```
O0001
M901P13
T101G99 (ROUGHING)
M331

G0X30Z2M18M403
G68;
G71 U3.5 R0.5
G71 P10 Q20 U0.4 W0.1 F0.6
N10 G00 X22.3
G01 Z-27
X23
Z-132.4
X26
N20 X30
G69
G0G53X-35Z250Y0
```

2 / SYNCHRONISATION BETWEEN CHANNELS

In this case the program needs to be written only in one path.

There are different codes for each channel. One channel is the master and the other is the slave

For X,Y,Z axis

Master	Slave	Activate	Cancel
1	3	M413	M423
2	1	M411	M421
3	2	M412	M422

For C axis

Master	Slave	Activate	Cancel
1	2	M414	M424
2	1	M414	M424

> **!**
>
> Both channels need to be synchronised by a MXX wait code before and after.
> G31 needs to be written in the slave channel after synchronisation is finished

PATH L (Upper right)	PATH D (Lower turret)
O0001	O0001
M901P13	M901P13
T101(ROUGHING)	T101G99(ROUGHING)
G50S2000	M331
G96S200G99F0.2M3M18M403	
M303	
G0X30Z2	G0X30Z2M18M403
M902P13	**M902P13**
M413(SYNCHRO-1-3 BALANCE CUTTING)	
GX22.5	
G1Z-27F0.6	
G0X30	
Z2	
G0X22.3	
G1Z-27	
X23	
G1Z-132.4	**M903P13**
G1X26	**G31**
G0X30	G0G53X-35Z250Y0
M423(CANCEL SYNCHRO 1-3)	
M903P13	
G0G53X-35Z250Y0	

3 / SYNCHRONISATION CODES BETWEEN PATHS

Same program will be written in each path and the start of each pass will be synchronised by a M9XX synchro code.

PATH L (Upper right)	Path D (Lower turret)
O0001;	O0001;
M901P13	M901P13
T101 (ROUGHING)	T101G99 (ROUGHING)
G50S2000	M331
G96S200G99F0.2M3M18M403	
M303	
G0X30Z2	G0X30Z2M18M403
M902P13	**M902P13**
GX22.5	GX22.5
G1Z-27F0.6	G1Z-27F0.6
G0X30	G0X30
Z2	Z2
M903P13	**M903P13**
G0X22.3	G0X22.3
G1Z-27	G1Z-27
X23	X23
G1Z-132.4	G1Z-132.4
G1X26	G1X26
G0X30	G0X30
G0G53X-35Z250Y0	G0G53X-35Z250Y0

Balanced cutting can be done in all our series equipped with live tooling:

TX SERIES

Y3 MODEL

Y2 QUATRO MODEL

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