



# Sinumerik ONE vs. SIMATIC Technology - G-CODE

Siemens Drives Days 2022, Dolní Morava

# | Kdo prezentuje

Ing. Adam Koncer

Siemens s.r.o.  
DI MC MTS  
Škrobářenská 511/5  
617 00 Brno

Telefon +420 721 560 462

E-mail [adam.koncer@siemens.com](mailto:adam.koncer@siemens.com)

[www.siemens.cz/sinumerik](http://www.siemens.cz/sinumerik)

# Co je to „G-CODE“?

## G-code

From Wikipedia, the free encyclopedia

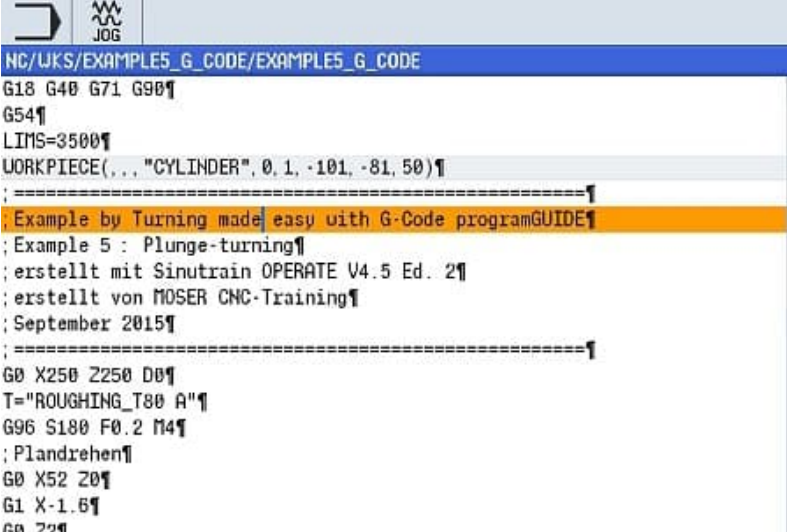
*For other uses, see G-code (disambiguation) and G programming language (disambiguation).*

*"RS-274" redirects here. For the photoplotter format, see Gerber format.*

**G-code** (also **RS-274**) is the most widely used **computer numerical control** (CNC) **programming language**. It is used mainly in **computer-aided manufacturing** to control automated machine tools, and has many variants.

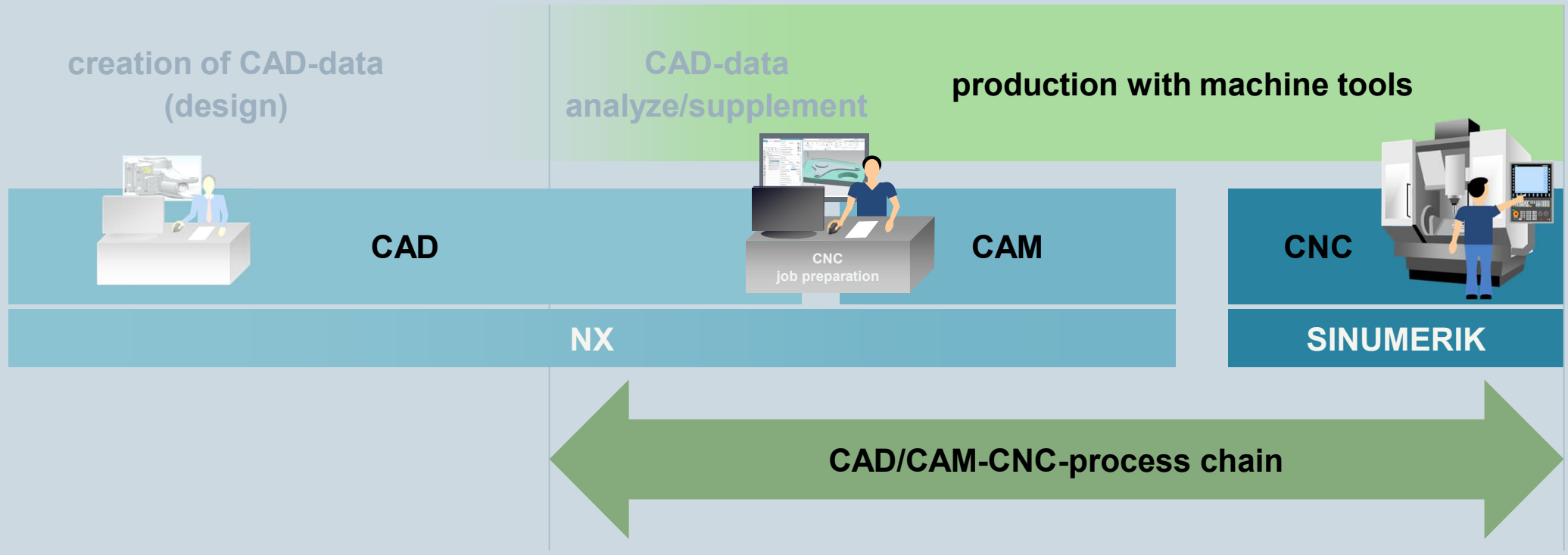
G-code instructions are provided to a machine controller (industrial computer) that tells the motors where to move, how fast to move, and what path to follow. The two most common situations are that, within a **machine tool** such as a **lathe** or **mill**, a **cutting tool** is moved according to these instructions through a toolpath cutting away material to leave only the finished workpiece and/or an unfinished workpiece is precisely positioned in any of up to nine axes<sup>[1]</sup> around the three dimensions relative to a toolpath and, either or both can move relative to each other. The same concept also extends to noncutting tools such as forming or burnishing tools, **photoplotting**, additive methods such as **3D printing**, and measuring instruments.

<https://en.wikipedia.org/wiki/G-code>



```
NC/WKS/EXAMPLE5_G_CODE/EXAMPLE5_G_CODE
G18 G40 G71 G90
G54
LIMS=3500
WORKPIECE(...,"CYLINDER", 0, 1, -101, -81, 50)
;=====
; Example by Turning made| easy with G-Code programGUIDE
; Example 5 : Plunge-turning
; erstellt mit Sinutrain OPERATE V4.5 Ed. 2
; erstellt von MOSER CNC-Training
; September 2015
;=====
G0 X250 Z250 D0
T="ROUGHING_T80 A"
G96 S180 F0.2 M4
; Plandrehen
G0 X52 Z0
G1 X-1.6
G0 Z2
```

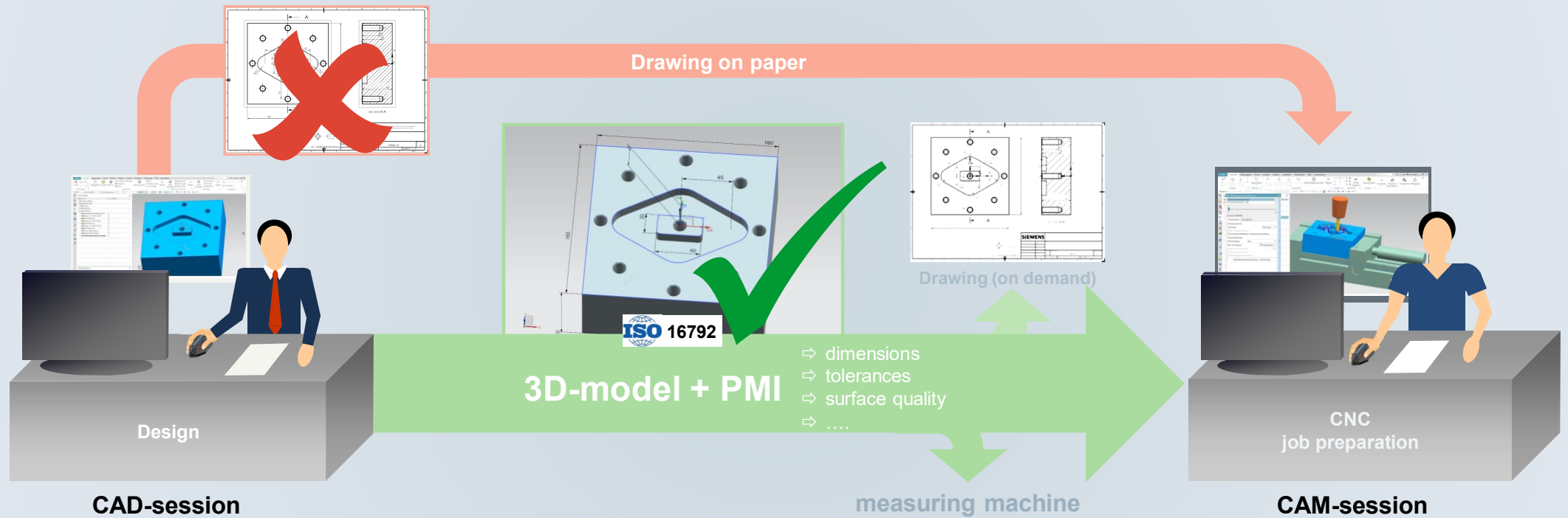
## CAD/CAM-CNC-process chain - production with machine tools



The term **CAD/CAM-CNC-process chain** primarily reflects the **production environment with machine tools**.

# Product Manufacturing Information (PMI) in NX

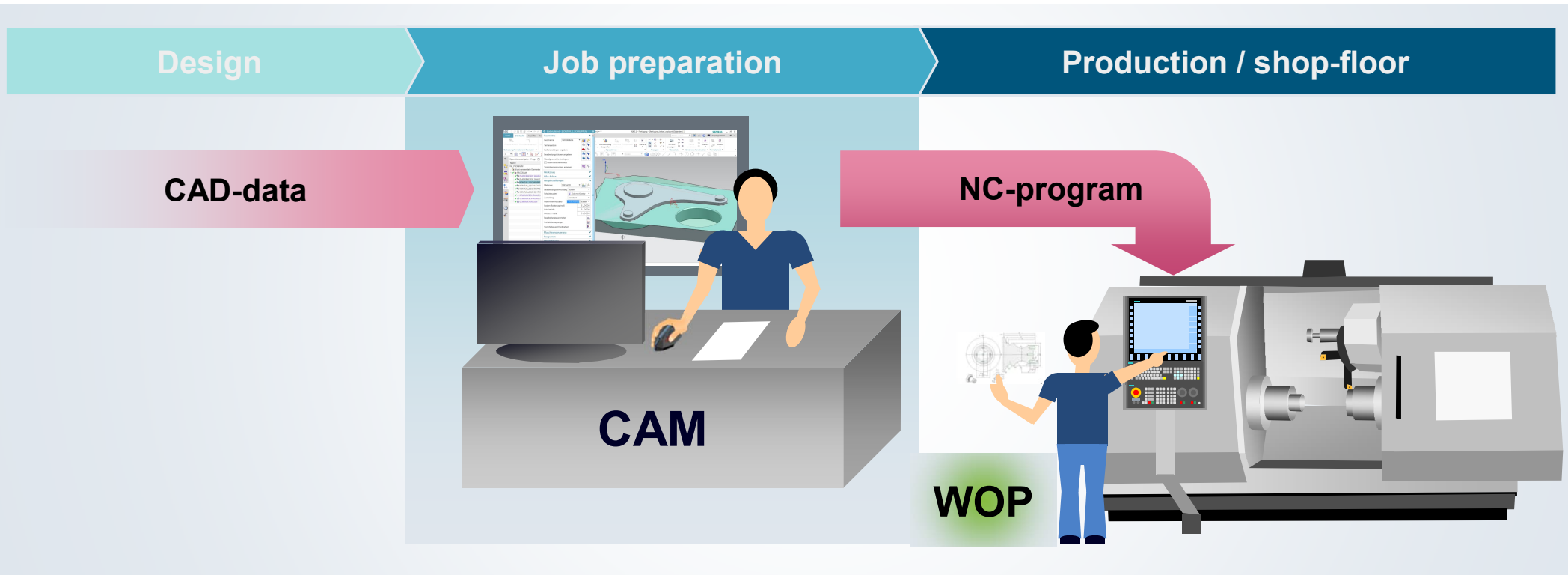
- the consequent step towards paperless production



**Product manufacturing information** (tolerances, dimensions ...) can be **assigned to the CAD master model** in NX and are thus available in the CAM session **without detour via technical drawings**.

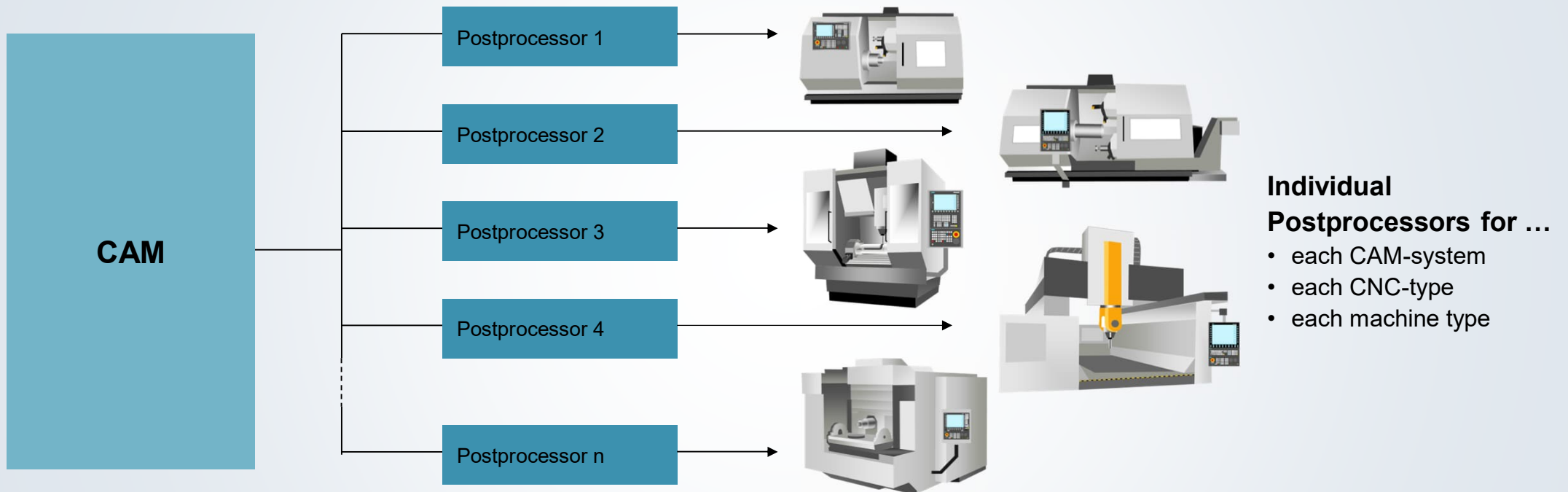
# CAM

- Computer-aided manufacturing



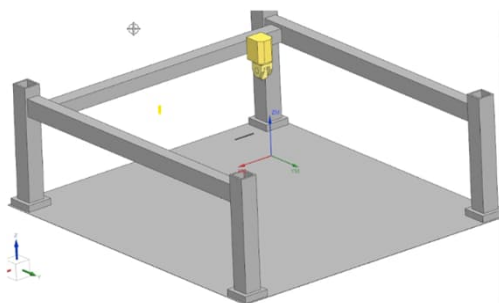
Computer-aided manufacturing refers to the use of **software that is independent of the CNC machine** to generate the NC code. In contrast to workshop-oriented programming (WOP), **NC programs are created in the job preparation phase.**

## Postprocessor - individual for each machine



**Postprocessors** of each CAM system must be **individually adapted** for the CNC type but also for each machine type.

## Získal jsem G-CODE, co dále?



+



+



+



```
NC/UKS/EXAMPLES_G_CODE/EXAMPLES_G_CODE
G18 G40 G71 G90
G54
LIMS=3500
WORKPIECE(...,"CYLINDER", 0.1, -101, -81, 50)
-----
Example by turning made also with G-Code programGUIDE
Example 5 : Plunge-turning
erstellt mit Sinutrain OPERATE V4.5 Ed. 2
erstellt von NOSER CNC-Training
September 2015
-----
G0 X250 Z250 D0
T="ROUGHING_T80 R"
G96 S1800 F0.2 M4
:Plandrehen
G0 X52 Z0
G1 X-1.6
an ?
```

Mechanika + elektrovybavení + řízení... **Sinumerik ONE** nebo? **S7-1500T** + „program“ v G-CODE

U obráběcího stroje je to jasná volba – Sinumerik ONE ☺ Co ale ostatní aplikace?



# Varianta SIMATIC Technology

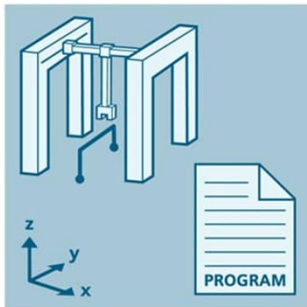
Entry type: Application example Entry ID: 109767009, Entry date: 11/26/2021

★★★★☆ (29)  
> Rate

## SIMATIC S7-1500T Kinematics Language

Entry Associated product(s)

The library LKinLang enables textual motion programming of kinematics. Besides the possibility to define user-specific textual languages, the motion program can also be defined in G-Code.



Motion programming with textual languages is comfortable and widely-used in many industries. Therefore, the standard application SIMATIC Kinematics Language enables the user to easily define a motion program for kinematics using different textual languages without an engineering system.

The library function blocks parse the textual program commands in a list (PathData), from where the commands are automatically executed by the function block MC\_MovePath (library LKinCtrl > 109755891).

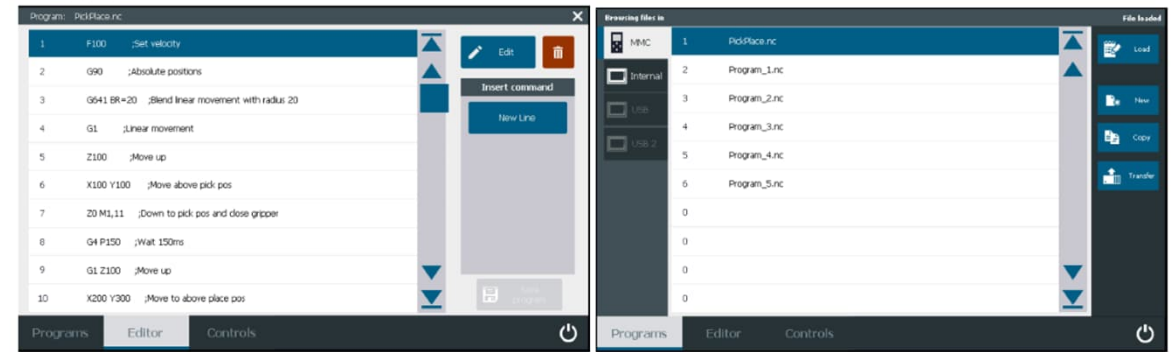
Besides the possibility to define user-specific textual languages, the motion program can also be defined in G-Code. The program commands can be created manually using text editors or in case of G-Code by export of suitable (CAD) - software. The resulting program will be stored on the SIMATIC memory card. File transfer is possible by accessing the web server via the user files or using the file transfer tool.

Following benefits are provided with this library:

- comfortable motion programming using textual languages
- G-Code programming with limited instruction set
- user-defined language definition
- 4D path interpolation
- storage of textual program files on memory card
- program file transfer via web server or transfer tool
- mathematical functions for programming
- control structures and variables for programming

<https://support.industry.siemens.com/cs/ww/en/view/109767009> +  
<https://support.industry.siemens.com/cs/ww/en/view/109755891>

### SIMATIC HMI Faceplates

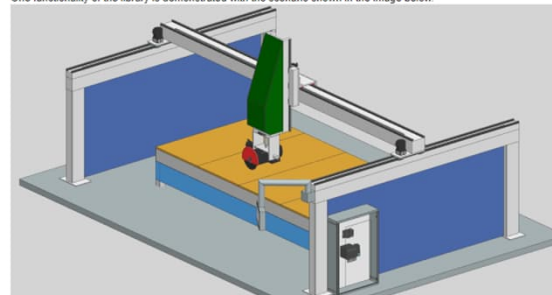


### SIMATIC File Transfer

The additional file transfer tool for windows enables to easily transfer files to the memory card from a computer connected to the SIMATIC PLC. Using the transfer tool the manual access to the web server can be avoided.

### NX MCD / SIMIT Model for SIMATIC Kinematics Language - Machining Centers

One functionality of the library is demonstrated with the scenario shown in the image below.



### Downloads

- Documentation V1.4.0 (3,8 MB)
- Library V1.4.0 for STEP 7 V16 (7,2 MB)
- Example Project for STEP 7 V16 (11,5 MB)
- SIMATIC FileTransfer V1.1.6 (0,4 MB)
- Changelog V1.4.0 (0,5 KB)

# Varianta SIMATIC Technology – praktická ukázka

The screenshot displays the Siemens SIMATIC Manager interface for a project named 'LKinLang\_ExampleProject\_V1\_4\_0\_V17'. The main window is divided into several panes:

- Project tree (left):** Shows the project hierarchy, including 'Devices & networks', 'Software units', and 'Program blocks'. The 'KinematicsMain [OB123]' block is selected.
- Network view (center):** Displays a network diagram showing a connection between 'PLC\_1 CPU 1517TF-3 P...' and 'HMI\_1 KTP700F Mobile' via a 'PN/E 1' connection.
- Connections (right):** Lists the devices and their connections, including 'PLC\_1', 'HMI\_1', and 'HMI\_1\_E\_CP...'. The 'PN/E 1' connection is highlighted.
- Program blocks (right):** Shows the 'KinematicsMain' block with its input and output variables. The 'Initial\_Call' input is set to 'Bool' and has a comment 'Initial call of this OB'.
- Block title (right):** Displays the block title 'Main Program Sweep (Cycle)' and the comment 'Motion program for TO\_Kinematics'.
- Network 1 and 2 (right):** Shows the network configuration for the program. Network 1 is 'Call LKinLang\_FileHandler - read file from card' and Network 2 is 'Call LKinLang\_Parser - parse program lines and write path data'.
- Ladder Logic (right):** Displays the ladder logic for the 'KinematicsMain' block. The logic starts with an 'EN' input, followed by a call to 'executeParser' and 'Parser'. The 'Parser' block is shown with its inputs and outputs, including 'language', 'syntaxCheck', 'flagMode', 'lineBuffer', 'pathData', 'preProcess Config', 'parameter Defaults', and 'interface Variables'. The 'Parser' block is also shown with its outputs, including 'done', 'busy', 'command', 'Aborted', 'error', 'status', and 'errorString'.

## Varianta SIMATIC Technology – cena v LP – bez slev

Sestava č.1.				Záruka (12-60 m.)	12						
				EEO (6-48 m.):	0						
Pozice	Počet	Objednáací číslo	Popis	Zákaznická Cena/ks €	Cena €	Sleva	Ceníková Cena/ks €	Hmotnost Brutto	Rožměr obalu d x š x v	Termín vysklad. prac. dny	
10	1	6ES7517-3FP00-0AB0	SIMATIC S7-1500F, CPU 1517F-3 PN/DP, Central processing unit with Work memory 3 MB for Program and 8 MB for data, 1st interface: PROFINET IRT with 2-port switch, 2nd interface: PROFINET RT, 3rd interface: PROFIBUS, 2 ns bit performance, SIMATIC Memory Card required	6 082,00	6 082,00		6 082,00	2,072 KG	22,3x19,8x15,9 CM	175	
20	1	6ES7954-8LL03-0AA0	SIMATIC S7, MEMORY CARD FOR S7-1X00 CPU, 3,3 V FLASH, 256 MBYTE	397,00	397,00		397,00	0,029 KG	10,6x9,4x0,7 CM	30	
		HMI		0,00	0,00						
30	1	6AV2124-0UC02-0AX1	SIMATIC HMI TP1900 Comfort, Comfort Panel, Touch operation, 19" widescreen TFT display, 16 million colors, PROFINET interface, MPI/PROFIBUS DP interface, 24 MB configuration memory, WEC 2013, configurable from WinCC Comfort V14 SP1 with HSP	4 317,00	4 317,00		4 317,00	6,63 KG	66x52x22 CM	200	
		CU320-2PN		0,00	0,00						
40	1	6SL3040-1MA01-0AA0	SINAMICS CONTROL UNIT CU320-2 PN WITHOUT COMPACT FLASH CARD	794,76	794,76		794,76	2,5 KG	226x50x300 MM	230	
50	1	6SL3054-0FC31-1BA0	SINAMICS S120 CompactFlash card incl. performance expansion incl. licensing (Certificate of License, stored on the card) V5.2 Service Pack 3	531,99	531,99		531,99	0,012 KG	0x0x0	5	
				0,00	0,00						
Součet zákaznických cen v EUR:					12 122,75						
Součet prodloužené záruky EEO (jednotek EEO/EUR)					0						
<b>Celková cena sestavy EUR:</b>					<b>12 122,75</b>						
Orientační cena v Kč:					297 189,22						

# SINUMERIK ONE

Entry type: Manual Entry ID: 109812272, Entry date: 07/20/2022

☆☆☆☆☆ (0)  
> Rate

## SINUMERIK ONE works steps for configuring and commissioning

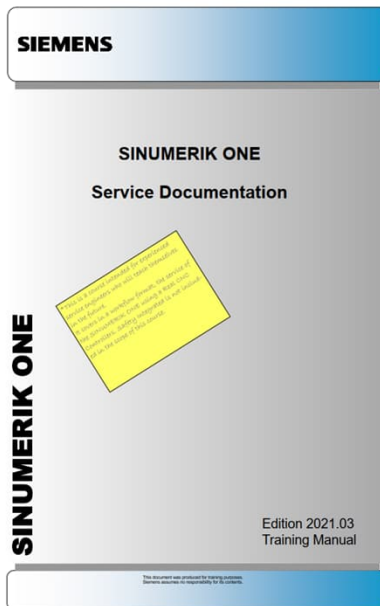
Entry Associated product(s)

Edition:  
07/2022

Commissioning Manual  
Document ID number: A5E47490947B AE

- Display
- Configure
- Download (5473 KB)
- Download as html5, only PC (19 MB)

<https://support.industry.siemens.com/cs/ww/en/view/109812272>



Entry ID: 109807400, Entry date: 03/02/2022

☆☆☆☆☆ (2)  
> Rate

## Technical Documentation for SINUMERIK ONE, Version 6.15 SP1

The following compilation is intended for manufacturers and users of SINUMERIK machine tools with SINUMERIK ONE, version 6.15 SP1. To make it easier to find the right contents, we have divided our documentation selection into the following categories:

User: Operating  
User: Programming  
Manufacturer/Service: Functions  
Manufacturer/Service: Hardware  
Manufacturer/Service: Configuring/commissioning  
Manufacturer/Service: Safety Integrated  
Information and Training  
Manufacturer/Service: SINAMICS



User: Operating



In our Operating Manuals, you will find information on the operator commands and operator controls of SINUMERIK Operate, tailored to the different processing technologies.

- > Operating Manual SINUMERIK ONE Universal
- > Operating Manual SINUMERIK ONE Turning
- > Operating Manual SINUMERIK ONE Milling
- > Operating Manual SINUMERIK ONE Grinding
- > Operating Manual SINUMERIK Access MyMachine /P2P (PC)
- > Operating Manual SINUMERIK Industrial Edge for Machine Tools Operating Protect MyMachine /3D Twin
- > Diagnostics Manual SINUMERIK ONE SINAMICS S120 Alarms

<https://support.industry.siemens.com/cs/ww/en/view/109807400>



# Sinumerik ONE – praktická ukázka

The screenshot displays the Siemens SIMATIC Manager interface for a Sinumerik ONE system. The main window is divided into several panes:

- Project tree (left):** Shows the project structure, including 'SolidCon\_UNI-1750\_V17\_Virtual', 'CNC\_2 [NCU 1750]', and 'PLC\_2 [PLC NCU 1750]'. It lists various components like 'Device configuration', 'Safety Administration', and 'Program blocks'.
- Network view (center):** Displays a network diagram showing the connection between 'CNC\_2 NCU 1750' and 'IO device\_1 IM 155-6 PN ST'. The connection is established via 'PROFIBUS Integrated\_2' and 'PN/IE\_1'.
- Network overview (right):** Shows the network configuration for 'CNC\_2', including 'PLC\_2', 'CP', 'HMI', 'NCK', and 'SINAMCS In...'. It also shows 'ET 200SP station' and 'IO device\_1'.
- OB1 [OB1] (right):** Shows the ladder logic program for the Organizational Block 1 (OB1). The program includes a call to 'LSP\_MainBP' and a network for 'navoleni rucniho panelu' (manual selection panel).
- Details view (bottom):** Shows the properties of the selected OB1, including 'General', 'Information', and 'Time stamps'.

The ladder logic program for OB1 is as follows:

```

1  CALL "LSP_MainBP"                                %FC2
2
3
4
5  CALL "LSP_MCPCtrlMilling"                         %FC19
6  BAGO :=16#1                                       16#1
7  ChanNo :=16#1                                     16#1
8  SpindleFNO :=16#6                                 16#6
9  FeedHold :="mezipameti".MCP_Feedhold             %DB100.DB_
10 SpindleHold :="mezipameti".MCP_Spindlehold       %DB100.DB_
11
12 AAA: A "bhg_prep0"                                %M101.6
13      JC AAA                                       %M101.6
14      AN "bhg_prep3"                                %M101.2
15      NOT
16      A "mezipameti".optiRucniPanel
17      A "LSP_ModeGroup".E_JOG
18      = "bhg_prep"                                %M101.6
19
20      AN "bhg_prep"                                %M101.6
21      R "LSP_Axis1".A_HW1                          %DB31.DBX_
22      R "LSP_Axis2".A_HW1                          %DB32.DBX_
23      R "LSP_Axis3".A_HW1                          %DB33.DBX_
24      R "LSP_Axis4".A_HW1                          %DB34.DBX_
25      R "LSP_Axis5".A_HW1                          %DB35.DBX_
26
27      A "bhg_prep"                                %M101.6
28      CC "Helppanel"                               %FC119
29

```

## Varianta Sinumerik ONE – cena v LP – bez slev

Sestava č.1.				Záruka (12-60 m.):	12					
				EEO (6-48 m.):	0					
Pozice	Počet	Objednací číslo	Popis	Zákaznická		Sleva	Ceniková Cena/ks	Hmotnost Brutto	Rozměr obalu d x š x v	Termin vysklad. prac. dny
				Cena/ks €	Cena €					
10	1	6FC5317-4AA0-0AA0	SINUMERIK ONE NCU 1740 with PLC-1500F	5 094,02	5 094,02		5 094,02	3 KG	0x0x0	80
20	1	6FC5852-1XG15-0YA0	SINUMERIK ONE CNC software 31-3 software 6.15 6 languages (en,de,fr,it,sp,zh-CHS) on SD card with electronic license (PDF)	2 184,27	2 184,27		2 184,27	0,01 KG	0x0x0	5
30	1	6FC5852-1XC15-0YA8	SINUMERIK ONE CNC software 31-3 with SINUMERIK Operate software 6.15 6 languages (en,de,fr,it,sp,zh-CHS) on DVD, without license	228,83	228,83		228,83	0,03 KG	0x0x0	5
40	1	6FC5800-0BA0-0YB0	SINUMERIK ONE 1 axis/spindle in addition software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	1 571,54	1 571,54		1 571,54	0,01 KG	0x0x0	5
50	2	6FC5800-0BB00-0YB0	SINUMERIK ONE additionally 1 positioning axis/ auxiliary spindle software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	559,70	1 119,40		559,70	0,01 KG	0x0x0	5
60	1	6FC5800-0BS60-0YB0	SINUMERIK ONE Safety Integrated - F-PLC software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	578,92	578,92		578,92	0,01 KG	0x0x0	5
70	6	6FC5800-0BK00-0YB0	SINUMERIK ONE Safety Integrated - axis/spindle software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	160,81	964,86		160,81	0,01 KG	0x0x0	5
80	1	6FC5800-0BN00-0YB0	SINUMERIK ONE additional languages software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	336,39	336,39		336,39	0,01 KG	0x0x0	5
90	1	6FC5800-0BM02-0YB0	SINUMERIK ONE pair of synchronous axes (gantry axes) software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	2 012,72	2 012,72		2 012,72	0,01 KG	0x0x0	5
100	1	6FC5800-0BM55-0YB0	SINUMERIK ONE sag compensation multi-dimensional software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	1 419,92	1 419,92		1 419,92	0,01 KG	0x0x0	5
110	1	6FC5800-0BP12-0YB0	SINUMERIK ONE additional HMI user memory on SD card of the NCU software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	272,97	272,97		272,97	0,01 KG	0x0x0	5
120	1	6FC5800-0BP77-0YB0	SINUMERIK ONE expanded CNC user memory software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	621,29	621,29		621,29	0,01 KG	0x0x0	5
		HMI		0,00	0,00					
130	1	6AV6646-1BA18-0NA0	SIMATIC ITC1900 V3, Industrial Thin Client, 19" widescreen TFT display, capacitive touch sensor, Supported protocols: RDP, VNC, SMARTSERVER HTML5 et. al., Neutral Design, panel mount	2 057,00	2 057,00		2 057,00	7,26 KG	62x40x14 CM	200
140	1	6FC5800-0BS00-0YB0	SINUMERIK ONE SINUMERIK Operate/NCU software option delivery of an electronic license (PDF) ***** email address for delivery is absolutely essential	312,24	312,24		312,24	0,01 KG	0x0x0	5
				0,00	0,00					
			Součet zákaznických cen v EUR:		18 774,37					
			Součet prodloužené záruky EEO (jednotek EEO/EUR)	0	0,00					
			<b>Celková cena sestavy EUR:</b>		<b>18 774,37</b>					
			Orientační cena v Kč:		457 719,14					

# Varianta Sinumerik ONE – opce

Project1 - SIZER for Siemens Drives - [Open-loop control / closed-loop control / 24 V / Cabinet Modules]

Project Edit Paste View Tools Window Help

Partial view: [Icons]

Controllers:

- Project1
  - Open-loop/closed loop co...
  - New controller
  - Controller, SINUMERIK
    - Controller/Closed-l...
    - Drive system / Sup...

Assign to another controller...

Cancel assignment

Controllable drive systems:

- Project1
  - Closed-loop control / 24 V ...
    - Compact, controllable ...

**Controller: SINUMERIK**

- Open-loop/closed-loop control electronics Yes
- Installation arrangement No details available
- DRIVE-CLIQ topology No details available
- 24 V supply Yes

Open-loop/closed-loop control electronics

**Dimension open-loop/closed-loop control electronics**

Open-loop control utilization:

Controller CNC software HMI Operator components I/O Repair service contracts Documentation

Order designation: 6FC5852-1XG15-0YA0 Required channels: 1

Version: 6.15 Required mode groups: 1

Order type: License key on data carrier only for the CNC Safety Integrated: F-PLC

CNC software, CD/DVD for axes/spindles (SINUMERIK Si): 6

Update service SI Connect: no

Cogging torque compensation: 0

Axis/spindle functions  Advanced Surface (S07)

Communication / data management  Drive-interpolating following axis Run MyCC DIFA + FASTIPO (R04)

Compensations  Involute interpolation (M21)

Couplings  Multi-axis interpolation (>4 axes) (M15)

Engineering software  Path acceleration limitation (P26)

**Interpolation**  Polynomial interpolation (M18)

Measuring  Retrace support (M24, requires M43)

Monitoring functions  Setting the jerk filter time AJET (N82)

Motion/synchronized actions  Spline interpolation (A, B, C splines) (S16)

Operating modes  Top Speed Plus (S62)

Operation  Top Speed Plus (S62) (eCoL)

PLC  Top Surface (S17)

Programming support

Simulation

Technologies

Tools

Transformations

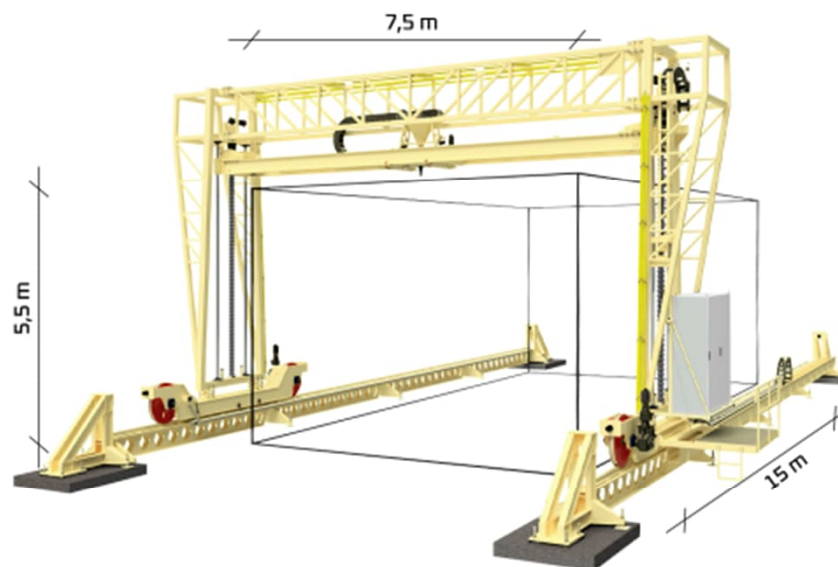
OK Accept Cancel Help

## Reference

# PODZIMEK 4.0

Pracovní prostor tiskárny má  
půdorys 15 m × 7,5 m  
a výšku 5,5 m.

## PARAMETRY 3D TISKÁRNY



```
M11  
M5  
;BEFORE_BLOCK_CHANGE  
G0 Z1860  
;UKONČENÁ HLADINA (1840)  
;BEFORE_LAYER_CHANGE  
;AFTER_LAYER_CHANGE  
;ACT_TIME:840,018887145097
```

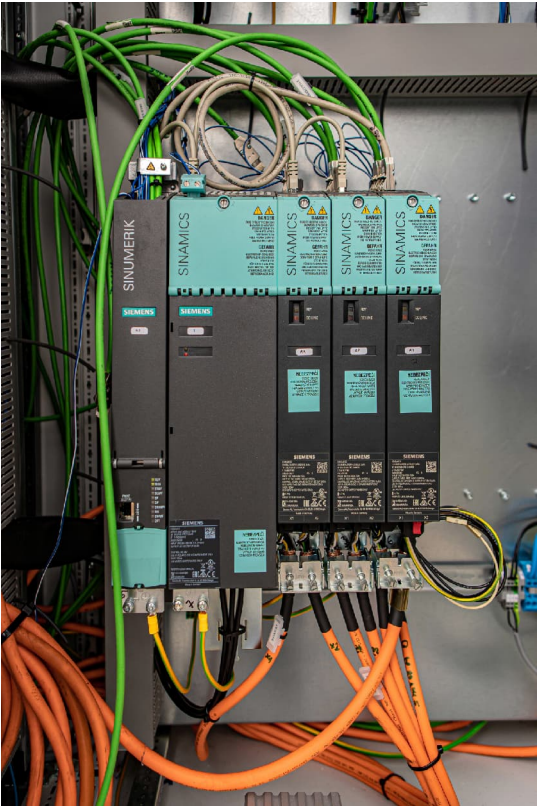
Koncepce portálu, poježdějícího po kolejnicích, s vertikálně se pohybujícím příčným, který nese tiskovou hlavu. Ovládání je založeno na průmyslovém řešení s využitím systému Sinumerik. Činnost tiskárny, včetně nástupu tuhnutí tiskové hmoty, řízena pomocí G-kódu.

<https://www.podzimek3d.cz/>



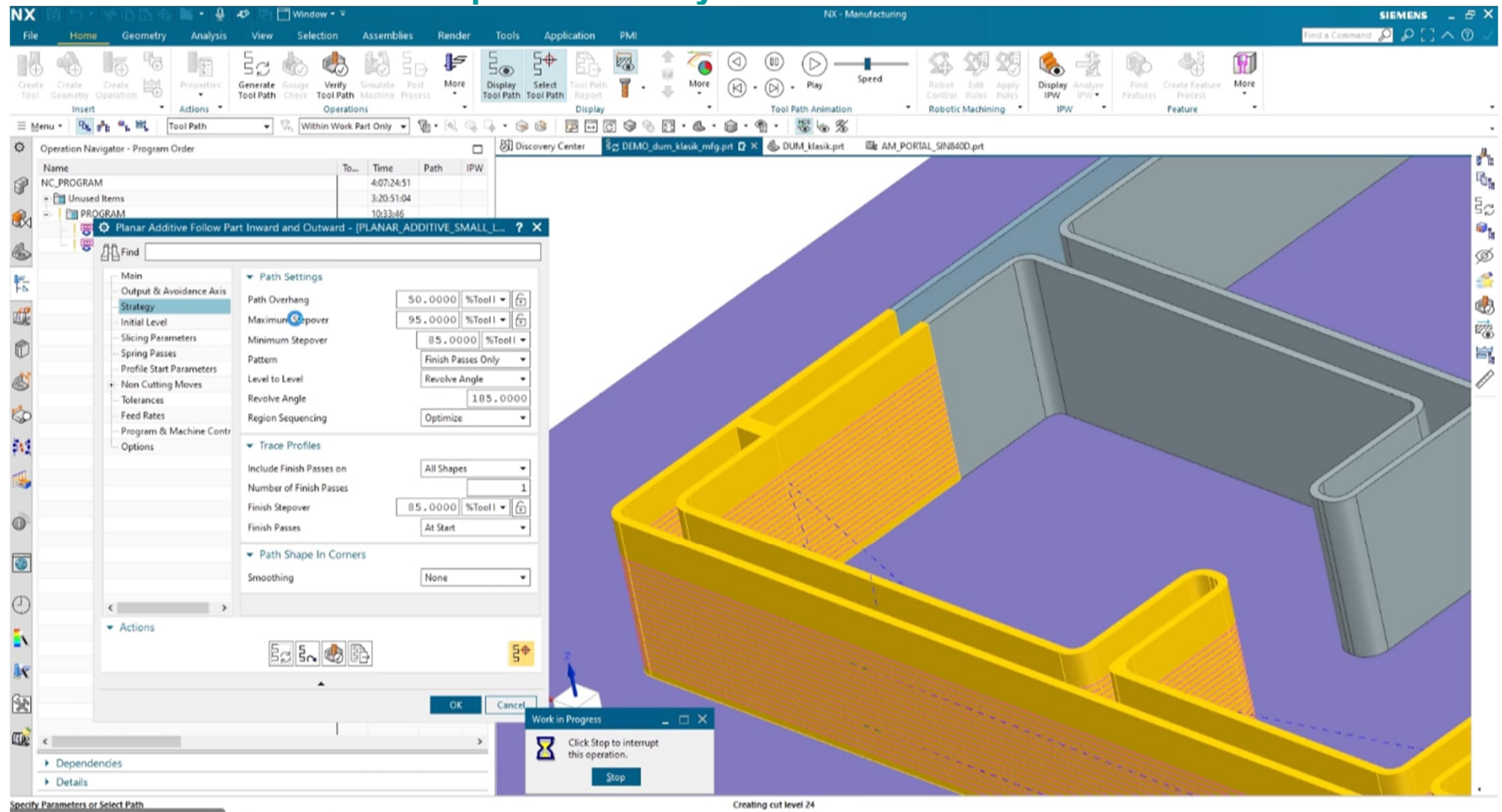
# Reference

# PODZIMEK 4.0





## Reference – co dáí? - NX CAM pro aditivní výrobu



**I Díky za pozornost**