ANGLED machining in WorkNC

1.option:
Rotate a model(from top-Z view, i.e. from current MACHINE axis) using rotations about axis in which you wish to make angled machining. Then when you are satisfied with rotations create a view with appropriate name.(This might cause some problems if machining the whole machining area, since then you must give the depth in that view to which you wish machining, but if the view was created purely from rotations(which is correct) you might not know the real depth, so you can have a problem defining the needed depth for machining the whole machining area.
In WorkNC v14 in new VisuNC you can modify view AFTER it has been created and saved, so you can also specify(position) exact depth.

2.option, (better solution):
From ISO view create an axis system for angled machining, and apply it. When applied, it is shown as it will be machined, and then you only have to define-create view with the same name, and that is it! Of course since you have defined the axis system and you know its exact position(also Z, i.e. depth) you can then exactly specify the desired depth(machining plane) when machining the whole machining area.
It is of course desirable if the CAD/surface model is in-house created, because you export surfaces only, but for angled machining you can create and export in IGES also a cube/hedgehog(wireframe), and also some lines(with predefined angles), so when selecting in WorkNC part geometry instead of only selecting surfaces(which is default) at the same time you can add also extremity curves and for the name of file select the same iges where the surfaces are(and contain also the cube/hedgehog). Then when the geometry is brought into WorkNC, i.e. it is calculated, and when you go in VisuNC, you will see(in white color) the "wireframe" model of cube/hedgehog(with additional lines if so created in your CAD system). Then it is very easy to create a new axis system for angled machining by simply selecting elements of this auxiliary wireframe geometry(with predefined angles).

Sample postprocessor for angled machining:

To utilize angled machining in postprocessor file
THERE MUST EXIST lines 66,67 and 69 ; see page 6-27 in WorkNC manual
In this example where there is comment(s)-line 15, the line
N4 G0 A~0 C~2 means pp writes output angles A and C
[A is rotation about X axis, C is about Z ; see page 6-26]
[~0 means angle A, ~1 angle B, ~3 angle C ; see page 6-32]
In line 14 there you can select option 1 (tool-tip) or 0(center)
You must check option 1(tool-tip) for some machines/controllers, otherwise you can get ERRORS on machine !

Sample Postprocesor :

```
1 %~p~a G71        : 1 Character at beginning of file
2  M30             : 2 Lines to add at end of file
 %~p~a G71
0 ;                : 3 Commentary: 0=no,1=yes,2=yes,with block nos
0 S                : 4 Spindle speed command
1 −3               : 5 Output format : 1=whole units(mm),2=1/100,3=1/1000
1                  : 6 Condensed mode: 0=no,1=yes
2 999990           : 7 Max. block nr. per file: 0=n/a,1-newfile,2-samefile
1 2 N 0            : 8 Initial block number: 0=no block numbers (instead of N can put #)
1 1                : 9 Incrementation between blocks
0 M3               : 10 Start up command
0 M30              : 11 Stop command

2 G0 5000 0        : 12 Rapid speed/1st point speed: 1=feeding speed,2=rapid speed
```

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```
2 G1                    : 13 Feeding speed: 2="F" and speed output with 1st pt only,1=each
1                       : 14 Point directed:  0=centre,1=tip(CENTER FOR ANGLED!!!)
5 2                     : 15 # of free-format lines,(20*75 max), 2=line auto-numbering
 T~n G17 ; Premer: ~w mm Radij roba: ~y mm
 S~b M03
 G90
 G0 G40 A~0 C~2
 ~4
1 .i                    : 16 Output file extension: 0='.blc'
0 *                     : 17 Characters to add at the end of each line: 0=n/a
0 300000                : 18 Maximum size in characters per file: 0=n/a, 1=new file
0 100                   : 19 Maximum distance machined per file: 0=n/a,1=new,2=same file
0 10                    : 20 No of lines between blocks: 0=n/a
1                       : 21 First point: 0=XYZ,1=Z only, 2=XY only
0                       : 22 Transformation to the machine axes: 0=n/a
0                       : 23 No of free-format lines, first file only
0                       : 24 Break the file at each z-level?
0                       : 25 Coordinate mode: 0=absolute,1=incremental
0                       : 26 Speed change rapid -> feed: 1=before, 2=after
0                       : 27 Speed change feed -> rapid:     "       "
1 1                     : 28 Commentaries required : header,distances
0 X Y Z                 : 29 Alternative axis labels : 0=n/a
0 0 1 F                 : 30 Format of feedrates : 0=n/a
1                       : 31 Tool axis rotation : 0=n/a (output of cutter angle)
1 G40 G41 G42           : 32 Tool correction(crv mach only):0=n/a[g41-left,g42-right,40-end]
0 50 H~e~g~h~i~j~kM13    : 33 Supplementary block
#34  H~e~g~h~i~j~kM13    : 34 command to output
#35  H~e~g~h~i~j~kM13    : 35 command to output
#40 $ 1                 : characters output with each cutter movement(in beginning of line if=1)
#41 1                   : 1= output in mm 2= output in inch
#44 1                   : output filename format composed of:proj and path number =1
#58 $                   : replace defined characters(in line 40)by space(s)
#61                     : number the lines defined in command line 2
#66 0 360 1             : Rotation of Z-Axis; min,max,step
#67 0 0 90 1            : Rotation of X/Y-Axis, 0=X  1=Y; min,max,step
#69 1 3
#72 M8 M9               : coolant on/off (command loads Mx or My in keyword ~4)

@(#)hdh426.dat          : KRIMSON for MICRON-Heidenhein426 (09-2000)
```

Another version of postprocessor :

```
0 %                     : Anfangskennung der Datei
6 L M09                 : Endekennung der Datei
L M05
L A0 C0 FQ3
M129
M30
END PGM ~p~a MM
1 ;                     : Kommentar: 0=nein,1=ja,2=mit Satznummer
0 S                     : Drehzahlkennung
1 3 0 0 1               : Format der Koordinaten: 1=mm,2=1/100,3=1/1000
1                       : Komprimierter Modus: 0=nein,1=ja
0                       : Max Satznr: 0=na,1=neue Datei,2=selbe Datei
```

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1 10 * 1	: Nr des 1. Satzes: 0=keine Satznr
1 1	: Inkrementierung der Satznummer
0 RO~kM	: Startkennung: 0=nein,1=ja
0 M02	: Stopkennung: 0=nein,1=ja
2 R0FMAX 19000 1	: Eilgang: 1=erster Satz im Vorschub,2=im Eilgang
1	: Vorschubgeschwindigkeit: 2=F.. nur im ersten Satz
0	: Referenz: 0=Mittelp,1=Spitze
0	: Zahl der Zeilen zur freien Verfuegg (max 20x75)
1 .h	: Extension des Fraesprogramms: 0='.blc'
0 *	: Zeilenendekennung: 0=nein,1=ja
0 300000	: Max Zeichenzahl: 0=na,1=neue Datei
1 0	: Max Fraesbahnlaenge in m: 0=na,1=neue,2=selbe Datei
0 10	: Zeilenabstand zwischen numerierten Saetzen: 0=na
0	: Format des ersten Satzes: 0=xyz,1=nur z
0 xzy	: Koordinatensystem auf der Maschine: 0=na
0	: Zahl der Zeilen zur freien Verfuegung in 1. Datei
1	: Aufteilen der Dateien in waagrechte Scheiben
0	: relativ: 0=absolut,1=relativ
0	: Zeile fuer Geschwindigkeitsaenderung Eilgang ->Vorschub
0	: Zeile fuer Geschwindigkeitsaenderung Vorschub->Eilgang
1 0	: Kommentare
1 X Y Z	: Name der Achsen: 0=na
0 0 0 ~kM	: Geschwindigkeiten als reelle Zahlen: 0=na
0	: Rotation der Werkzeugachse: 0=na
0 G40 G41 G42	: Werkzeugkorrektur: 0=na
0 50 H~e~g~h~i~j~kM13	: zusaetzlicher Satz
#34 H~e~g~h~i~j~kM13	: zusaetzlicher Satz
#35 H~e~g~h~i~j~kM13	: zusaetzlicher Satz
#40 L 1	: Zeilenendekennung in Zeilen mit Werkzeugbewegung
#41 1	: 1= Ausgabe in mm 2= Ausgabe in Zoll
#44 1	: Dateiname ohne Dateinummer
#48 1	: Eilgangskennung steht hinter den XYZ-Koordinaten
#52 9	: Aufruf fuer Werkzeugwechsel
FN*0:*Q2*=*~"11"*;*Anfahrvorschub	
FN*0:*Q3*=*~"10"*;*Fraesvorschub	
TOOL*CALL*~n*Z*S~b*;*Werkzeugwechsel	
L*~j*R0*FMAX	
L*~H*~I*R0*FMAX	
M128	
M118*X0*Y0*Z0*A0*C0	
L*A~0*C~2*FQ3	
L*M03	
#58 *	: Ersetzen des definierten Zeichens durch Leerzeichen
#61	: Nummerieren der Zeilen aus Zeile 2
#62 3	: Programmkopf, (Ausgabe nach Zeile 1)
0 BEGIN PGM ~p~a MM	
1 CYCL DEF 32.0 TOLERANZ	
2 CYCL DEF 32.1 T0.01	
#66 -300 +300 0.001	: Drehung der Z-Achse
#67 0 -110 +110 0.001	: Drehung der X/Y-Achse, 0=X 1=Y
#69 1 3 0 1 0 0	: Format der Winkelausgabe fuer ~0, ~1, ~2, (wie Zeile 5)
#72 M08 M09	: Kuehlung ein/aus, Aufruf mit ~4
#80 Q3 Q2 Q3	: Vorschub als Parameter, Eilg:Q1, Zustell:FQ2, Fraesen:FQ3
(#)HH430_Zim.dat	8.7 /17/8/2000 PP WORKNC Zimmermann FZ30, FZ35

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When you want to use this postprocessor to write some angled machining in WorkNC you MUST **NOT** select axis system (i.e. leave it blank), since it is used ONLY if you wish to ADDITIONALY move postprocessed data to some different x,y,z !!!

HIGH SPEED ROUGHING

1. Da bi bila obdelana cela cona, mora machining window biti povecan za vrednost parametra stepover (ko je vklopljena/aktivna avtomatika). Stepover je 40% premera frezarja za HSC roughing, in za toliko je treba razširiti cono, da bi bila obdelana kompletno od zgoraj (brez stranskih navpicnih sten).

2. Cutlink distance za roughing in roughing-remachining naj bo ~2 premera rezkarja.

3. Minimum-to-remove stock naj ne bo manjsi od ~0.5 mm. Ponavadi pa je dobra vrednost, ce definiramo stock allowance 0.3-1mm, da je primerno temu vrednost min-to-remove stock 0.6-2mm (skratka ~2xstock allowance).

The value of **smoothing radius** should be between zero and 25% of tool diameter. Good value is **20-25% of tool diameter**.

HSM island/pocket machining

1. SPIRAL should be between 2 mm and diameter of tool. The size of spiral is defined for each MACHINE differently! And in such a way that get:
-minimal (if possible) MINimal restmaterial (for areas where we go "through" material
(for instance between two "steep" walls).
-minimal machine vibrations

2. BY LEVELS (subniveaus) is alternative to SPIRAL

Delta Z (z-step) is about 1/3 of Z-step (this is O.K.)
This method for HSC roughing is currently the best.

3. options (DIRECT) ONLY for OLDER machines and SOFT materials.

Environment variable:
WNC_HSR_STEP=on (in environ.cfg) Does NOT produce error message for HSC roughing if we disable AUTO(which is set to be 40% of tool diameter) for stepover. In this way we are able to use HSM roughing for older machines and soft materials !

For LAST roughing remachining the diameter(radius) of the tool should be at least 2(1)mm SMALLER than for the first next (semi)finishing toolpath. This is of paramount importance when HSM roughing is involved.

For HSM roughing lead-in radius should be ~tool radius. If we have VERY good HSM machine than this lead-in radius can be smaller.

For Optimized Z-level finishing it is suggested to select CONTOUR for cycle type.

Using restmat contours:

Calculate restmat based on (several) toolpath(s)
Then in VisuNC :
it is good if we first "hide/blank" part (depressing button show)
then do the following:

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curves import and for name enter restmat

then define/enter arbitrary name for curves
for limit enter yes
(DO NOT SAVE-when saved you can not edit any more !!!)
Then if we want to modify this new curve, we must:

we select one of the operations: add/remove/edit
then pick curves to remove/edit
or/and (later) chose to add
Continue the process as long as not satisfied with result.

Postprocessing

```
              ^x
              |
              |
              x-----> y  (2)

^
|
|
x-----> y (1)
```


Axis system is activated (selected) ONLY if we wish AFTER already calculated toolpathes to translate it and/or rotate it to different coordinate system.
If we wish the complete computation from axis system (1) to be postprocess in (2) then we choose/select ONLY for postprocessing the axis system (2) !
This is NOT used for angled machining itself !!!

Kreiranje (manjkajocih) ravnih površin v WorkNC:

V utilities izbrati opcijo:

Flat Surface Create

Pred tem seveda moramo v VisuNC kreirati zaprte krivulje za manjkajoce RAVNE površine. Ce je manjkajocih površin vec, je lahko po ena krivulja kreirana z ukazom add , ampak VEDNO na isti višini/globini/Z-ju.

Ce so manjkajoce površine na razlicnih Z, potem za vsak Z kreirati krivuljo.

Flat Surface Create nas potem sam usmerja kaj narediti, in ko konca kreira dodatno geometrijo z imenom krivulje in koncnico wnc.

(še ena obrazložitev : ce smo kreirali krivuljo na nekem Z-ju, bo površina kreirana na tem Z-ju. Ce želimo definirati drugi Z, to tudi dolocimo, in je potem

površina kreirana ne na globini krivulje, temvec na naši doloceni/vpisani vrednosti.)

Potem pa v WorkNC coni dvakrat kliknemo na part, da se pokaže meni in izberemo WorkNC zapis in dodamo ime*.wnc kot smo ga(jih) kreirali. Vsaki ima ime default po imenu krivulje kot je bila definirana v VisuNC.

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Edge computing

V utilities opcija Edge Computing:

pretestira KOMPLETEN part model in najde odprte in/ali dvojne robove, katere si lahko ogledamo v VisuNC.
To je zelo uporabno ce dobimo model od neznanega partnerja in bi si pred obdelavami radi ogledali
potencijalno problematicna obmocja-slabo trimane površine, površine ki se preklapajo…
V VisuNC izberemo curves, show in za ime vtipkamo: edge

Kreiranje WORKNC modela iz NC(ISO) datotek (v ASCII formatu)

[pogoj je , da je kroglni rezkar premera vec kot 0.]

Postopek:

Kreirati "prazno" WorkNC cono.
V tej coni odpreti DOS okno (shell), in vtipkati:

wncbatch trapos
[ce so podatki v Renishaw-Formatu, potem:
c:\Worknc99\exe\msw\benz2res]
Na vprašanje za output(izhodno datoteko) moramo vpisati:
total.res
(te podatke potem lahko vidimo v VisuNC, tako da pokažemo/pogledamo
pot z imenom total.res)
Potem v istem DOS oknu vtipkamo:
wncbatch menusurf
(definirajo se xmin,xmax,ymin,ymax in zmax)
Kot rezultat se kreirajo:
calsurf.par und reduc.par
Potem v istem DOS oknu vtipkamo:
wncbatch calsurf
Rezultat je:
facet.wnc
Potem štartamo WorkNC in za part geometrijo izberemo WorkNC zapis
in seveda že kreirani facet.wnc

Ko so ti podatki aktivirani veljajo za njih vse strategije obdelave
ki so na raspolago v WorkNC-ju.

Ce imamo podatke z 3D merilnega stroja bodo v stereolitografskem formatu (stl). Te podatke lahko
zapišemo v WorkNC format v DOS oknu z ukazom:

stl2wnc
(akceptira ASCII ali binarni zapis)
Izhod je "ime".wnc
(stl2wnc omogoca tudi redukcijo modela, ce nas zadovoljuje manjša natancnost).
Potem startamo WorkNC in za part geometrijo izberemo WorkNC zapis in seveda že kreirani "ime".wnc
Ko so ti podatki aktivirani veljajo za njih vse strategije obdelave ki so na raspolago v WorkNC-ju.

IGES Interface options:

For EUCLID

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The two files in $WNCHOME/client/instsite are:
1. Nurbsopt.dat empty
2. Parmarc with entry 1 on the first line of the file

For PROENGINEER, Cimatron
The two files in $WNCHOME/client/instsite are:
1. Parmarc with entry 2 on the first line of the file
2. Nurbsopt.dat with entry 0 on the first line of the file

For UNIGRAPHICS Version 9.3.5 or higher
Must exist in $WNCHOME/client/instsite :
Nurbsopt.dat
with entry 1 on the first line of the file

environ.cfg

```
[var]
WNCUNITS=mm
WNCLANG=ang                         #( for english language is ang, for german is all)
WNC_LICENSE_SERVER=localhost
WNC_KEY_DEVICE=com1 ( or com2 … )
WNCWORKLIST=c:\worknc14\gendoc\workinfo.ang
WNCDATAOUT=$WNCZONE\nc_post   #( directory of selection )
WNCDATAIN=e:\exim\              #( directory of selection )
WNCDATAGAM=c:\worknc99\standard\
WNCUSEBATCH=on                     #( or off )
WNCUSERAD=diameter                 #( or radius )
WNC_FLAT_CUTTER=0
WNC_BATCH_SERVER=name
WNC_BATCH_LIMIT=number
DEVUSI = off                       #( WorkNC development options status : on,off )

WNC_HSR_STEP=on
WNC_TEST_FIZSPLINE = on    # (Zlevel…off-old method)
WNC_TEST_WNCFIZ3E = on
WNC_TEST_FINSPLINE = on    # (finishing)
WNC_TEST_3DSPLINE  = on    # (remachining ,3d_drive… off - old method)
WNC_CAN_SCALE=1            # ( by default is 0, i.e. not; for small parts use value 1.5,2,3… )
WNC_MENU_COMMAND_PREFIX=$WNCHOME\Utilities\WncCalculation\WncCalculation.exe -wncnosrch
WNC_CALC_AUTOCLOSE=1
WNC_CUTTER_HOOK_LABEL=Cutter
WNC_CUTTER_HOOK_COMMAND=$WNCHOME\Utilities\WncToolLibrary\WncToolLibrary.exe           -tpnum
&TP_NUM
WNC_CUTTER_HOOK_SAVE_DIR=$WNCZONE
WNC_CUTTER_HOOK_EXEC_FLAGS=2
WNC_DOC_HTML_IN  =makedoc.htm  #create html docu in English
WNCPOSPRO=f:\wncpospro\          #directory for worknc postprocessors
WNC_CUTTER_DIR=f:\wnctoollib\       #directory for worknc tools
```


wncplot.bat

```
rem @(#)wncplot.bat  WORKNC/KRIMSON
rem Print a HPGL file on a HP laserjet printer
%WNCBIN%\hp2lj –d300 %1 c:\raster.tmp –s %2x%3
```

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rem for local printer
copy /b c:\raster.tmp LPT1:

rem for remote printer
rem   \\ime remote racunalnika\ime remote tiskalnika
rem copy /b c:\raster.tmp \\worknc\laserjet

del c:\raster.tmp

del hrdcpy.hp

%WNCBIN%\wncmain echo "del %1" > _command.bat
call _command.bat

WorkNC HOLDER COLLISION CHECK(v nadaljevanju HCC)

Ce se dela HCC za naslednje operacije v WorkNC-ju:

-contour-roughing
-high-speed cutting
-roughing remachining

za NC operacije tipa grobih obdelav,
se HOLDER COLLISION CHECK
SME uporabiti SAMO ZA DOLOCANJE MINIMALNE POTREBNE DOLŽINE ORODJA !
POT SE NE SME DELITI !! NE SME SE SHRANJEVATI NITI NONCOLLIDED DEL POTI !!