ARCS

G2 = CW arcG3 = CCW arcParameters: X,Z = end point of arcI,K = distance to center point of arc from start (l is in radius units, not diameter units) F = feedrate

CONVEX ARC EXAMPLE

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CONVEX ARC EXAMPLE

GOO TO2O2 (15DEG DIAMOND TOOL, TOOL 2) G50 S2000 (CLAMP SPEED AT 2000) G96 S#502 (CONST SURF SPEED) G99 (FEED PER REV) GOO X[#500 + 10.0] Z[#501 + 10.0] (GET CLOSE) MO3 (SPINDLE ON) GOO X[#500] Z20.0 (INITIAL POINT FOR ROUGHING) MO8 (TURN ON COOLANT) G71 U2.0 R0.75 (2MM DOC, 0.75MM RETRACT) G71 P100 Q110 U0.5 W0.25 F#503 N100 GOO XO.O Z19.0 (ENTRANCE POINT) G03 X38.0 Z0.0 10.0 K-19.0 F#504 GO1 X38.0 Z-3.2 N110 GOO X[#500+2.0] (EXIT)

GOO X[#500 + 10.0] Z[#501 + 10.0] (GET CLOSE) (INITIAL POINT FOR FINISHING) GOO X[#500] Z20.0 G70 P100 Q110 F#504 (FINISH PASS) GOO X[#500 + 2.0] (BACK OFF) M09 M05 G28 UO WO

CONCAVE ARC EXAMPLE

- Drill center hole
- Use boring tool to rough and finish cavity



THREADING CYCLE

- Threading requires multiple passes in perfect synchronization to reach final thread depth.
- Must make sure you are in constant spindle speed mode, not constant surface speed!

COMPUTING THREAD PARAMETERS

- Overall thread height
 - H = Pitch*(0.5 / tan 30deg) = 0.866025*Pitch
 - Ext thread depth = $(17/24)^{*}H = 0.613435^{*}Pitch$
 - Int thread depth = $(5/8)^*H = 0.541266^*Pitch$







 $G76X(u) = Z(W) = R(i) P(k) Q(\Delta d) F(L);$

m ; Repetitive count in finishing (1 to 99)

This designation is modal and is not changed until the other value is designated. Also this value can be specified by the parameter No. 5142, and the parameter is changed by the program command.

r : Chamlering amount

When the thread lead is expressed by L, the value of L can be set from 0.0L to 9.9L in 0.1L increment (2-digit number from 00 to 90). This designation is modal and is not changed until the other value is designated. Also this value can be specified by the parameter No. 5130, and the parameter is changed by the program command.

a : Angle of tool tip

One of six kinds of angle, 80-, 60-, 55-, 30-, 29-, and 0-, can be selected, and specified by 2-digit number.

This designation is modal and is not changed until the other value is designated. Also this value can be specified by the parameter No. 5143, and the parameter is changed by the program command. m, r, and a are specified by address P at the same time.

(Example)

When m=2, r=1.2L, a=60°, specify as shown below (L is lead of thread).

- $P = \frac{02}{m} = \frac{12}{r} = \frac{60}{a}$
- ∆dmin : Minimum cutting depth (specified by the radius value) When the cutting depth of one cycle operation (∆d – ∆d –1) becomes smaller than this limit, the cutting depth is clamped at this value. This designation is modal and is not changed until the other value is designated. Also this value can be specified by parameter No. 5140, and the parameter is changed by the program command.
- Finishing allowance This designation is modal and is not changed until the other value

is designated. Also this value can be specified by parameter No. 5141, and the parameter is changed by the program command.

- i Difference of thread radius If i = 0, ordinary straight thread cutting can be made.
 k Height of thread
 - : Height of thread This value is specified by the radius value.
- ∆d : Depth of cut in 1st cut (radius value)
- L : Lead of thread (same as G32).



- G76 Pffppaa Qddd Rfff (first line of G76) -ff = # of finish passes (01-99)
 - pp = # revolutions for gradual pull-out (0.0-9.9=00-99)
 - -aa = angle (60 degrees for us)
 - ddd = last depth of cut (min.cutting depth)
 (positive radial value, no decimal point microns)

- fff = finish allowance (mm, dec.point allowed)

• G76 Xxx Zzz Ppp Qqq Fff (2nd line) -xx = last thread pass diameter-zz = Z endpoint of thread - pp = height of thread (pos.radial value, microns) -qq = 1st threading pass depth (max.cutting depth, pos.radial value, microns) - ff = feedrate (same as thread lead)

- Example: M24x2 external thread
 - -GOO X30.032 Z[#501 + 6.0]
 - G76 P010060 Q005 R0.0
 - G76 X24.43 Z[#501-10.0] P1360 Q0544 F2.0

MULTISTART THREADING

- Example: M24x2 three start external thread
 - #1=2.0 (PITCH MM)
 - #2=0.5/TAN[30.0] * #1 (H)
 - #3=#2 * 17.0/24.0 (THREAD DEPTH)
 - #4=3 (NUMBER OF STARTS)
 - #5=0 (START NUMBER)
 - GOO X32.0 Z[#501 + 3 * #1 * #4] (START 3X LEAD AWAY)
 - WHILE [#5 LT #4] DO 1
 - GOO X30.032 Z[#501 + #1 * #5 + 3 * #1 * #4]
 - G76 P100060 Q005 R0.0
 - G76 X23.39 Z[#501-10.0] P[FIX[#3*1000]] Q0544 F[#1*#4]
 - #5 = #5 + 1
 - END 1