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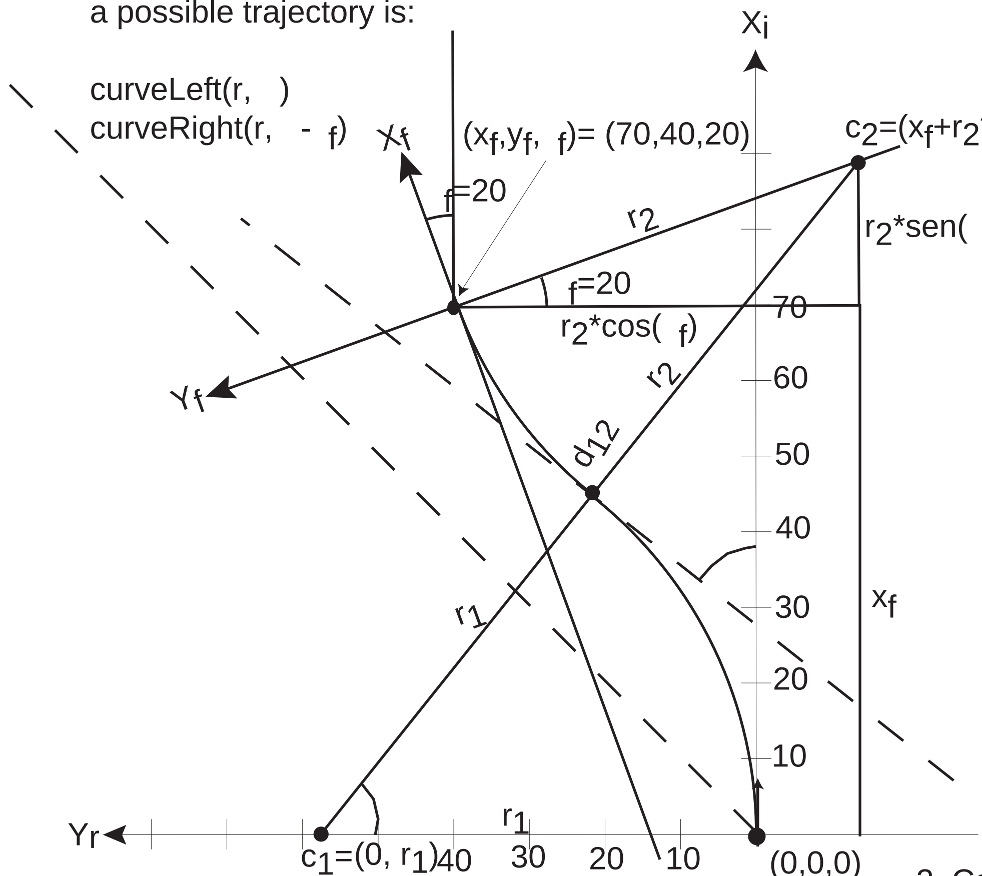
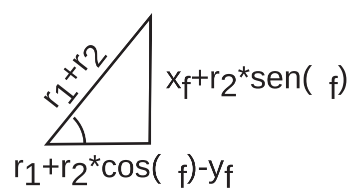
# Theoretical trajectory 2

Consider a final point($x_f$, $y_f$, $_f$).
When $x_f$,>$y_f$ and 45> $_f$>-90 and $y_{c_2}$<$y_{c_1}$,
a possible trajectory is:

curveLeft(r, )
curveRight(r, - $_f$)




1. Calculate $r_1$ e $r_2$ using the distance $d_{12}$ between points $c_1$ and $c_2$, which define the center points of two circunference arcs of each curve:

$c_1$= ($x_{c_1}$, $y_{c_1}$) ,
$x_{c_1}$= 0 and $y_{c_1}$= $r_1$, implies
$c_1$= (0, $r_1$).

and,

$c_2$= ($x_{c_2}$, $y_{c_2}$) ,
$x_{c_2}$= $x_f$+$r_2$*sen( $_f$) and $y_{c_2}$= $y_f$-$r_2$*cos( $_f$), implies
$c_2$= ($x_f$+$r_2$*sen( $_f$), $y_f$-$r_2$*cos( $_f$)).

then,

$d_{12}$=(($x_f$+$r_2$*sen( $_f$))$^2$ + ($r_1$-$y_f$+$r_2$*cos( $_f$))$^2$)$^{0,5}$= $r_1$+$r_2$.

As the equation of $d_{12}$ has two unknown variables $r_1$ e $r_2$, there are three solutions to get only one unknown variable:

i. $r_1$=$r_2$=r => (2*r)$^2$=($x_f$+r*sen( $_f$))$^2$ + (r*(cos( $_f$)+1)-$y_f$))$^2$.

ii. $r_1$=C => ($r_2$+C)$^2$=($x_f$+$r_2$*sen( $_f$))$^2$ + (C+$r_2$*cos( $_f$)-$y_f$))$^2$.

iii. $r_2$=C => ($r_1$+C)$^2$=($x_f$+C*sen( $_f$))$^2$ + ($r_1$+C*cos( $_f$)-$y_f$))$^2$.

2. Calculate of angle ,
sen( )=($x_f$+$r_2$*sen( $_f$))/($r_1$+$r_2$),

=arcsen(($x_f$+$r_2$*sen( $_f$))/($r_1$+$r_2$)).

3. For the example (70,40,20) and considering solution i), the terms of resolvent formula are,
a=2-2*cos( $_f$),
b= 2*$y_f$*(1+cos( $_f$))-2*$x_f$*sen( $_f$),
c= -($x_f^2$+$y_f^2$)
applying resolvent formula,
r= 56,94 => $r_1$=$r_2$=56,94
from equation in point 2, will get
= 51,78

The theorethical trajetory is,
CurveLeft(56.94, 51.78),
CurveRight(56.94, 31.78).

**Note**: In practice, robot is not able to do a curve with a radius of 56,94 cm due the manobrability constraints of robot.