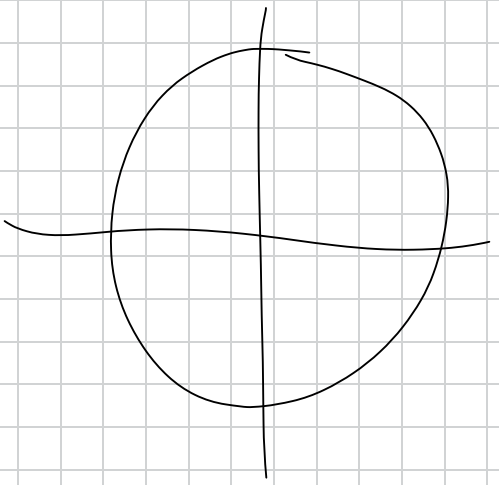
LAB 2 - Oppgaver



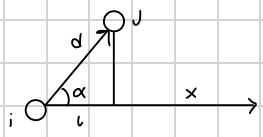
Oppg. 3 N_{max}

midt til midt. hvis rapport — sjekk med ytterkant, fler samples mellom

$$n_{max} = \frac{d}{c} \cdot f_s = \frac{6{,}5\text{cm}}{343\text{m/s}} \cdot \frac{1}{\frac{1}{31250}} = 5{,}92\ldots \approx 5 \text{ samples}$$

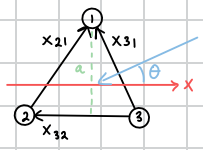
Oppg. 4 Innfallsvinkel

To mikrofoner



$$\cos\alpha = \frac{b}{d} = \frac{b}{|x_{ji}|} = \frac{-cT_{ji}}{|x_{ji}|}$$

Tre mikrofoner



T_{21}, T_{31}, T_{32}

utrykk: $x_{ji} \cdot x + cT_{ji} = 0 \quad j_i = 21, 31, 32$

Løser ved least mean square, ved å også innføre en feil ε

$$\varepsilon^2 = \sum_{ji} (x_{ji} \cdot x + cT_{ji})^2 = \sum_{ji} (x_{ji}x + y_{ji}y + cT_{ji})^2$$

Finne x og y slik at ε^2 minimeres

For å finne θ må man bruke x og y

$$\theta = \arctan\left[\frac{y}{x}\right]$$

Videre er x og y gitt av

$$x = \frac{CD - BE}{AD - B^2} \qquad y = \frac{-BC + AE}{AD - B^2}$$

$x_{sensor1} = [0, 1]\,a$

$x_{sensor2} = [-\sqrt{3}/2, -0{,}5]\,a$

$x_{sensor3} = [\sqrt{3}/2, -0{,}5]\,a$

$$\theta = \arctan\left[\sqrt{3} \cdot \frac{r_{31} + r_{21}}{r_{31} - r_{21} + 2r_{32}}\right] = \arctan\left[\sqrt{3} \cdot \frac{n_{31} + n_{21}}{n_{31} - n_{21} + 2n_{32}}\right]$$

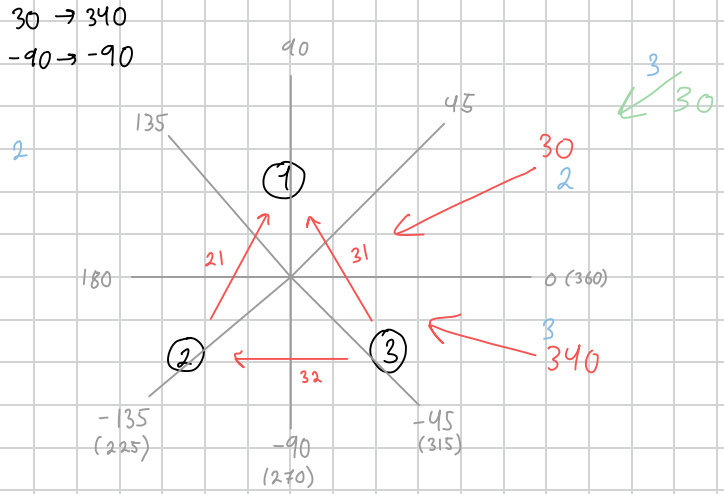
Gir oss kun vinkler i intervallet $\theta \in [-90°, 90°]$

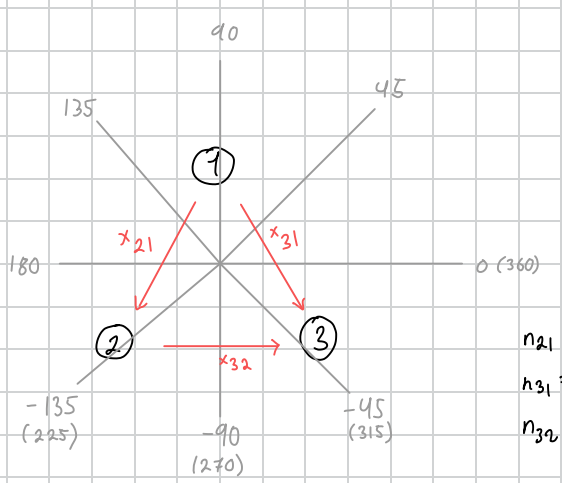
↳ legge til π i estimatet hvis $x < 0$,

dvs. hvis $(-n_{21} + n_{31} + 2n_{32}) < 0$

ønsket vinkel		Vinkel målt	n_{21}	n_{31}	n_{32}		Vinkel 2	n_{21}	n_{31}	n_{32}
(360)	0									
	45	43	1	4	3		46	1	5	3
	90	89,9	1	5	-2					
	135									
	180									
(-135)	225									
(-90)	270	280	1	5	-3		274	1	6	-3
(-45)	315	313	1	5	-7					

150 → 30
30 → 340
-90 → -90





$n_{21} = 0$
$n_{31} = 5$
$n_{32} = 5$

$-90° = -89°$
$30° = 20°$
$150° =$

$n_{31} - n_{21} + 2n_{32}$: 5 0 10

15 -15

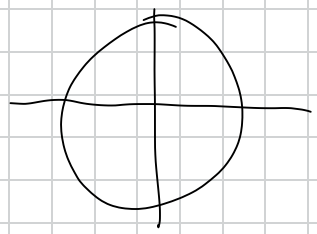
-1 -4 + 2(-5)
-1 -4 -10 = -15

Not good ☹
ingen spike
90°
40°

Good ☺
spike og vinkelestimat
0° → 0,0°
60° → 59,9°
120° → 101°
150° → 149°
180° → 173,4°
-10° → -13,89°
-40° → -46°
-70° → -79°
-90° → 266° (ish -90)
-110° → 252° (ish -110)
-150° → 199 (ish -150)

30_1 → 38
30_2 → 29
30_3 → 29

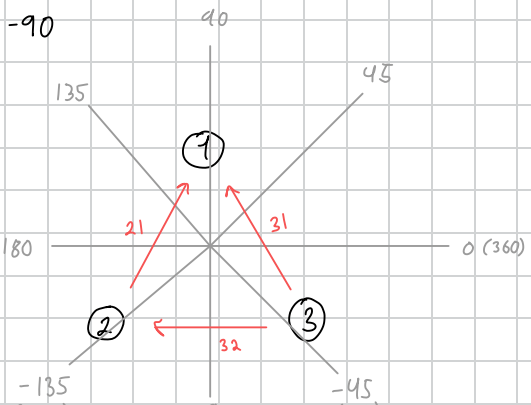
-4	-4
0	0
4	0



arctan( ) → -90, 90

-90 + 180 = 90
-89 + 180 = 91
-45 + 180 = 135
-10 + 180 = 170
0 + 180 = 180
10 + 180 = 190
45 + 180 = 225
90 + 180 = 270

150 → 30
30 → 340
-90 → -90



$n_{31} - n_{21} + 2n_{32}$

(-120/240)

(5,1,-1) : 1 - 5 - 2 = 300 (120 + π)

(055) : 5 - 0 + 2·5 → 15

max 21 - 1
max 31 - 1
max 32 - 1

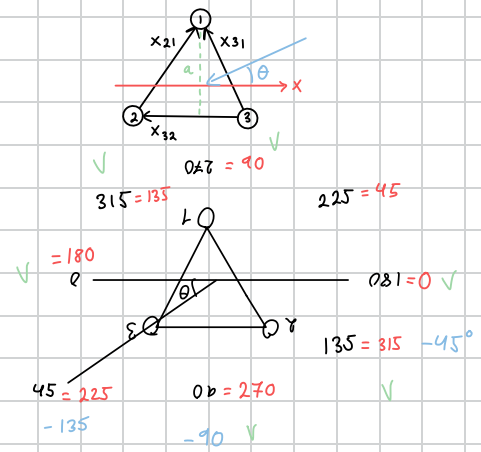
Nr.4 - Klapp w/+pi

			N_{21}	N_{31}	N_{32}	
0	=	-90	-3	-3	0	-90
45	=	0	0	0	4	
90	=	0	0	0	0	
135	=	-19	-2	0	4	45
180	=	-60	-4	0	0	
(225) -135	=	-19	-2	0	4	45
(270) -90	=	-19	-2	0	4	45
(315) -45	=	40	-1	-5	-4	(135)

Nr.4 - Klapp w/+pi

			N_{21}	N_{31}	N_{32}
0	=	-90	-3	-3	0
45	=	0	0	0	4
90	=	0	0	0	0
135	=	-19	-2	0	4
180	=	-60	-4	0	0
(225) -135	=	-19	-2	0	4
(270) -90	=	-19	-2	0	4
(315) -45	=	40	-1	-5	-4

n_{21}	n_{31}	n_{32}
-1 -	1 -	5 -
-	0	-
-	+	0
0	+	+
+	+	+
+	0	+
+	-	0
0	-	-



Nr.1 = Sinus

-45°	= -51°
-90°	= 259°
-135°	= 166°
0°	= -16°
45°	= 90°
90°	= 94°
135°	= NAN
180°	= 120°

Nr.2 - Klapp

0°	= -89°
45°	= 0°
90°	= 0°
135°	= -19°
180°	= -60°
-135°	= -19°
-90°	= -19°
-45°	= 220°

Nr.3 - Klapp - Arctan2

-45° = 40°
0° =

	n_{21}	n_{31}	n_{32}
0	-3 -	-3 -	0 -
45	0 -	0 0	4 -
90	0 -	0 +	0 0
135	-2 0	0 +	4 +
180	-4 +	0 +	0 +
-135	-2 +	0 0	4 +
-90	-2 +	0 -	4 0
-45	-1 0	-5 -	-4 -

	n_{21}	n_{31}	n_{32}
0	-3 -	-3 -	0 -
45	0 -	0 0	4 -
90	0 -	0 +	0 0
135	-2 0	0 +	4 +
180	-4 +	0 +	0 +
-135	-2 +	0 0	4 +
-90	-2 +	0 -	4 0
-45	-1 0	-5 -	-4 -