SDR TRANSCEIVERE

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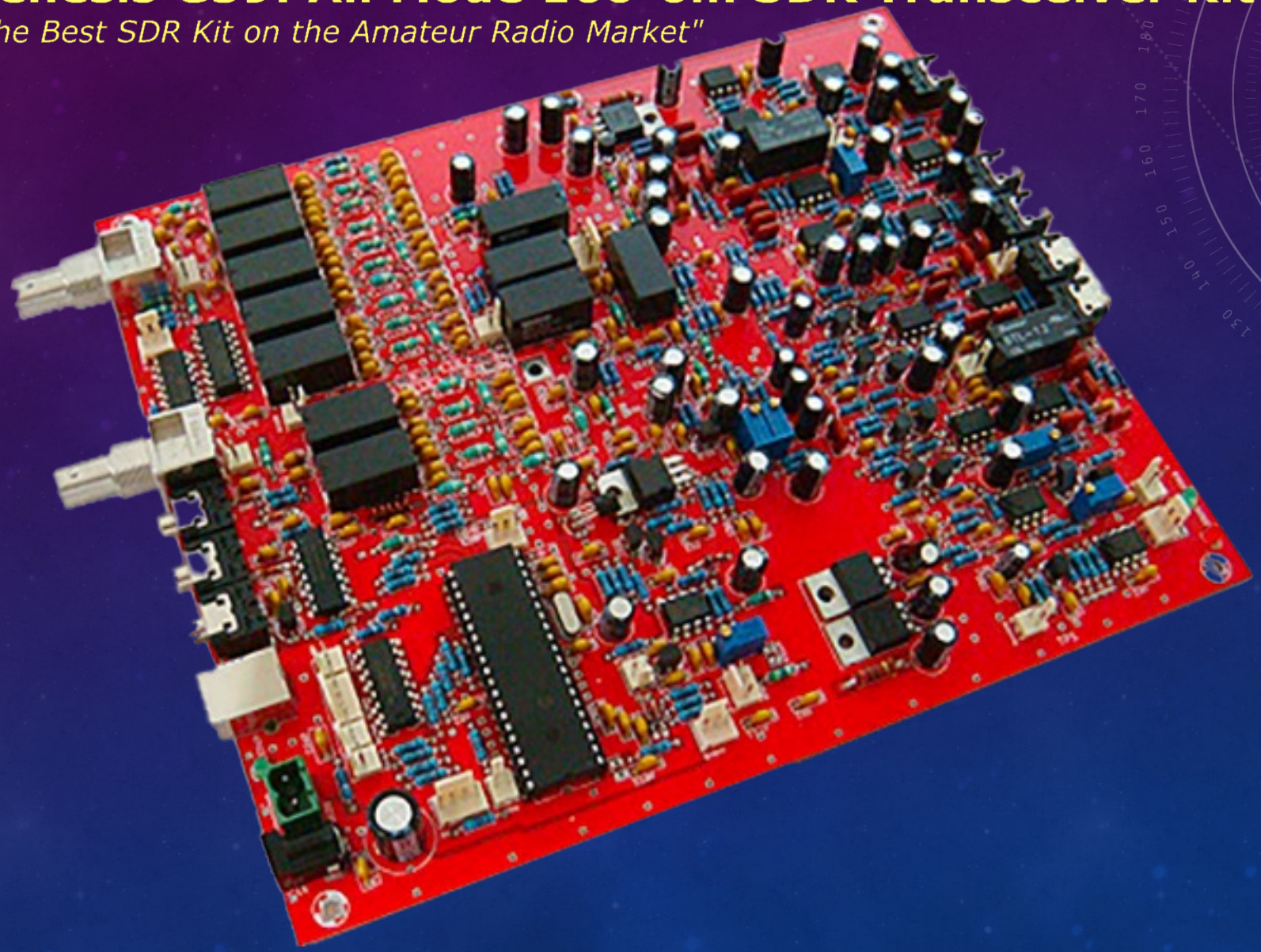
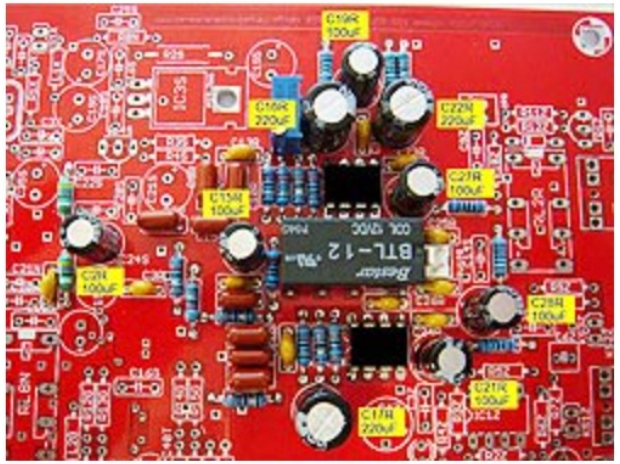
8. DECEMBER 2022

OZ7SKB

Genesis G59: All Mode 160-6m SDR Transceiver Kit

"The Best SDR Kit on the Amateur Radio Market"





Phase Five: G59 Receiver Assembly

After completion of phase 5, your G59 receiver will come to life! You will be able to tune to your favourite HF band and enjoy the software-defined radio experience! Even as is -without any filters or preamplifier - the receiver will perform surprisingly well. You will also learn how to adjust the image rejection with both hardware and GSDR software. Finally, you will have your G59 connected to DIGI modes and start receiving and uploading WSPR spots! Great fun!
Click **here** to proceed.

Phase Six: Installation of Components Input-Output High-Pass Low-Pass Filters, Attenuator and Preamplifier

In this phase, you will install components in the HP-LP filters, attenuator and preamplifier. Next, you will interconnect the preamplifier and attenuator with the microcontroller and check their performance. Your receiver will be fully functional once you complete phase six.
Click **here** to proceed.

SDR TRANSCEIVERE

HVAD ER I OG Q?

MODULATION VED HJÆLP AF I- OG Q-SIGNALER

HVORDAN GENSKABER MAN I OG Q UD FRA SIGNALET PÅ ANTENNEN?

FFT – FAST FOURIER TRANSFORMATIONER

UNDERTRYKKELSE AF SPEJLFREKVENSER

NYERE GENERATIONER AF SDR

HVORFOR SDR?

BASEBAND - PASSBAND

Passband

Frekvens start: f_1

Frekvens slut: f_2

Båndbredde BW: $f_2 - f_1$

Baseband

er resultatet af den operation, som transformerer intervallet

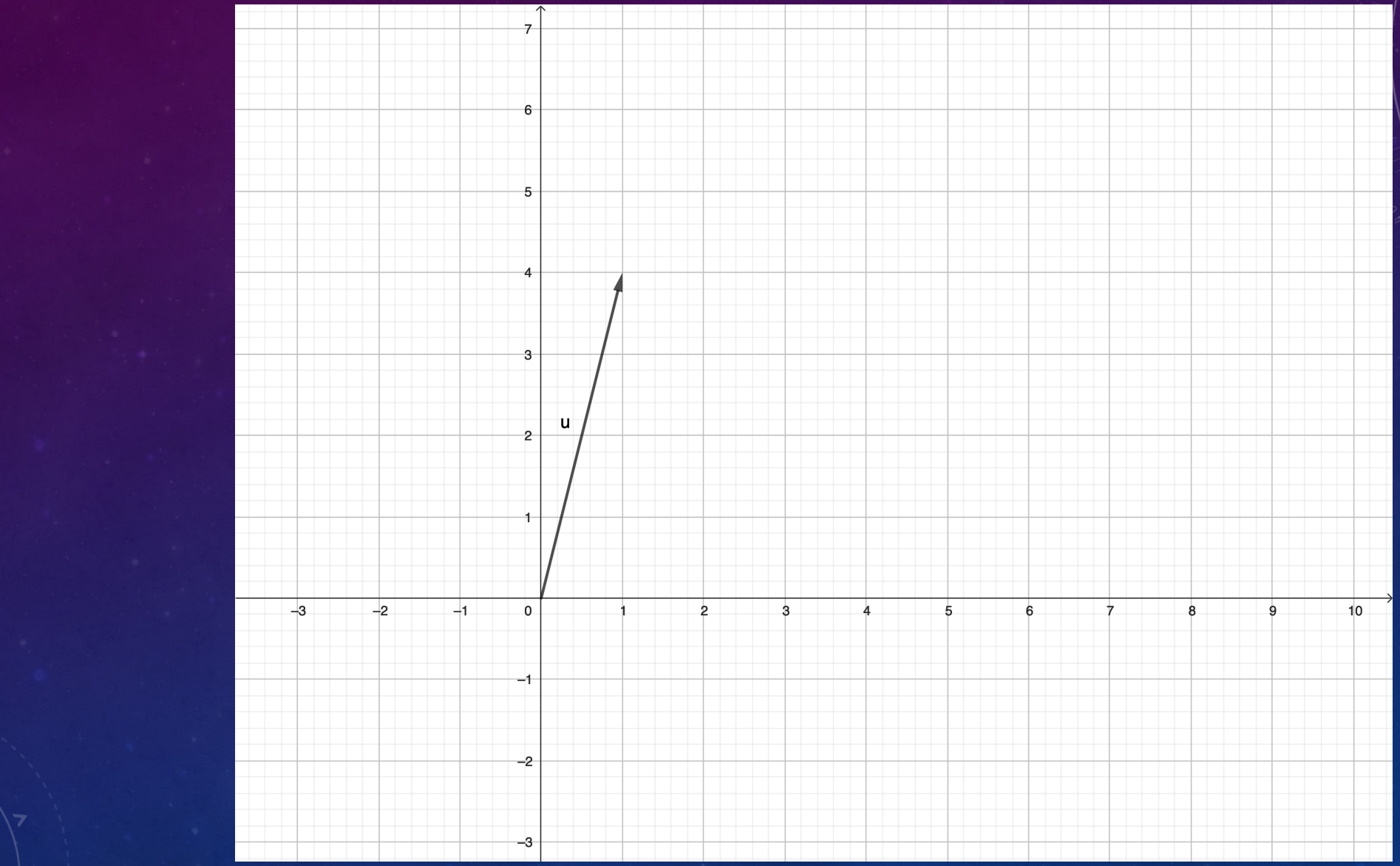
$]f_1; f_2]$

til intervallet

$]0;BW]$.

Transformationen skal bevare den information, som Passband indeholder (være ækvivalent).

VEKTORER



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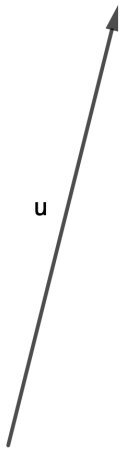

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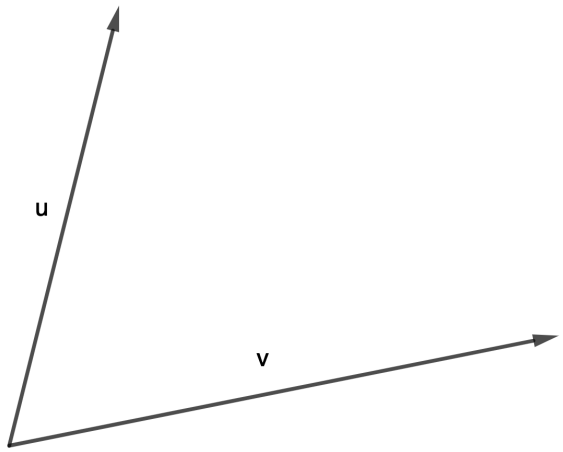

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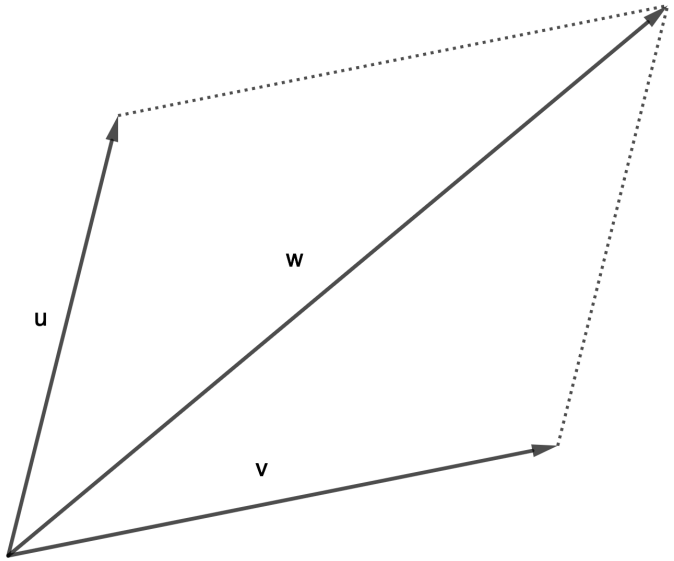
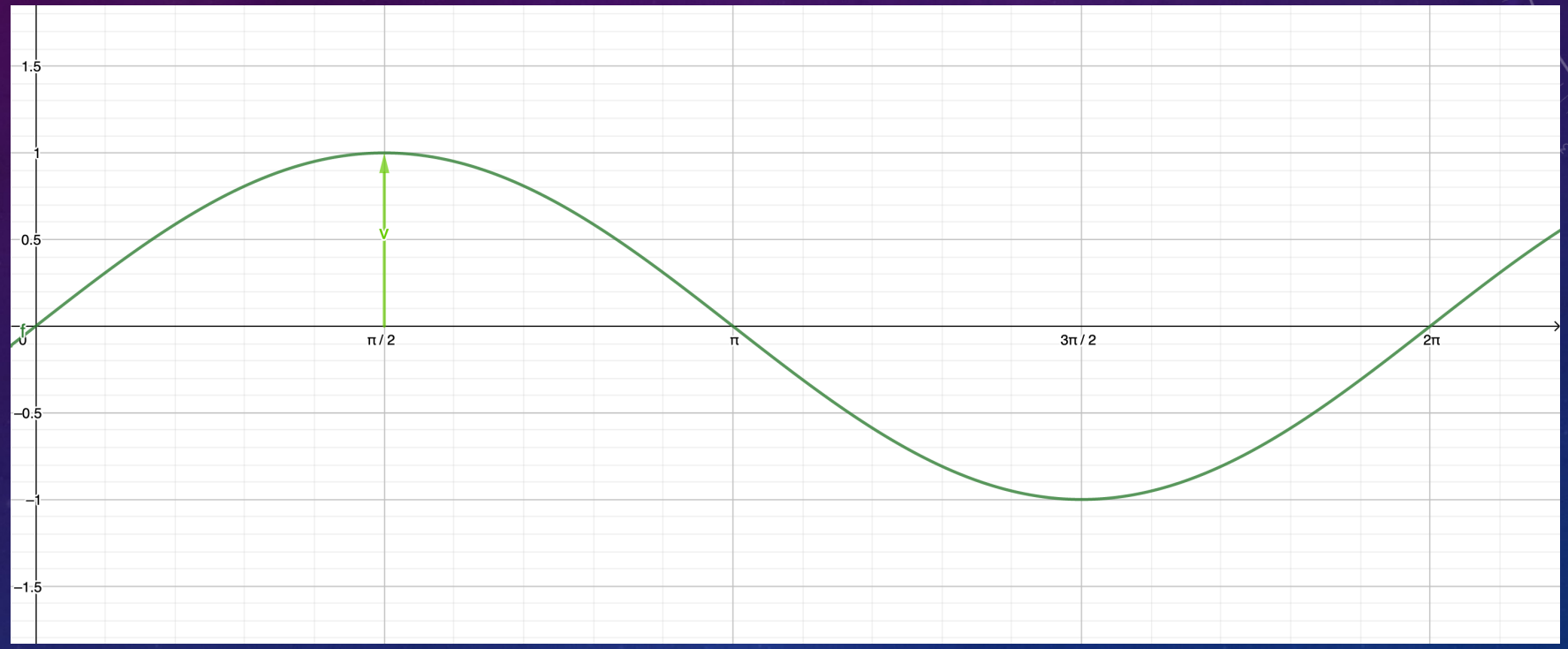
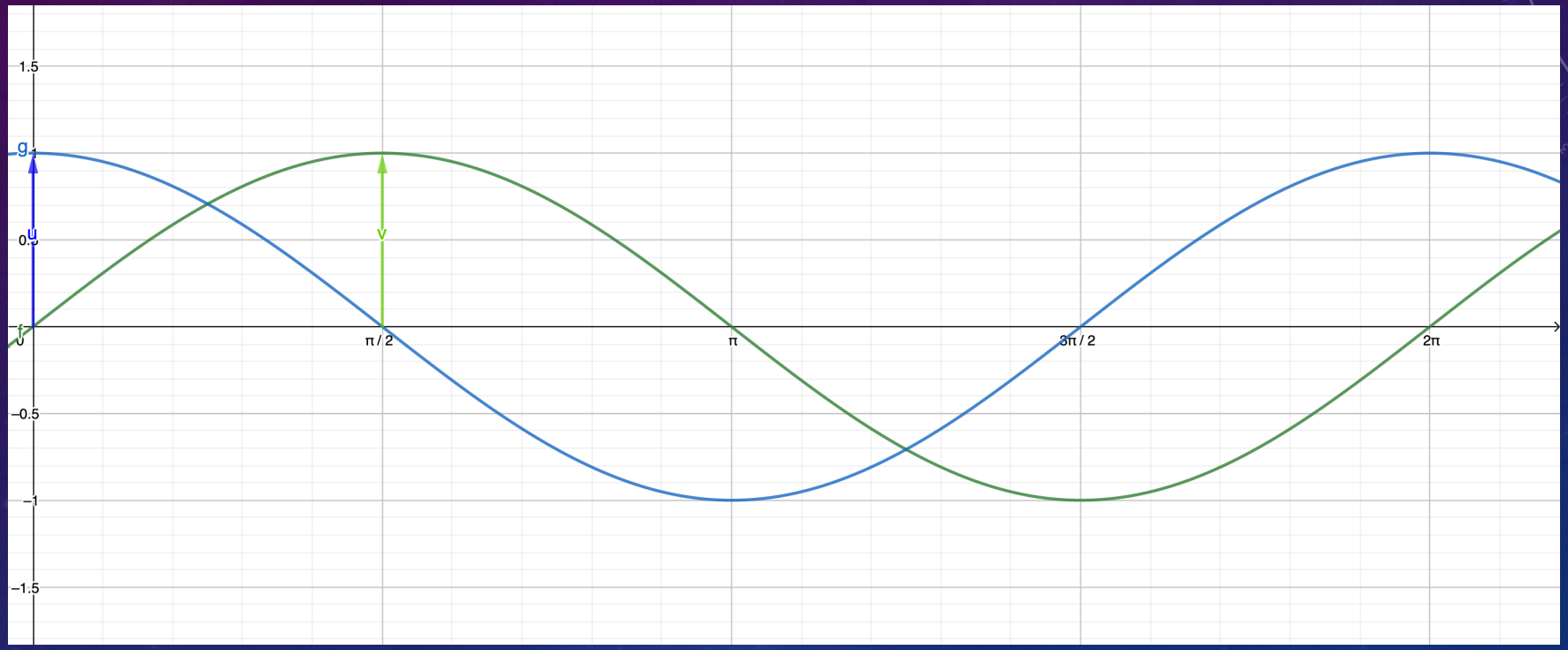


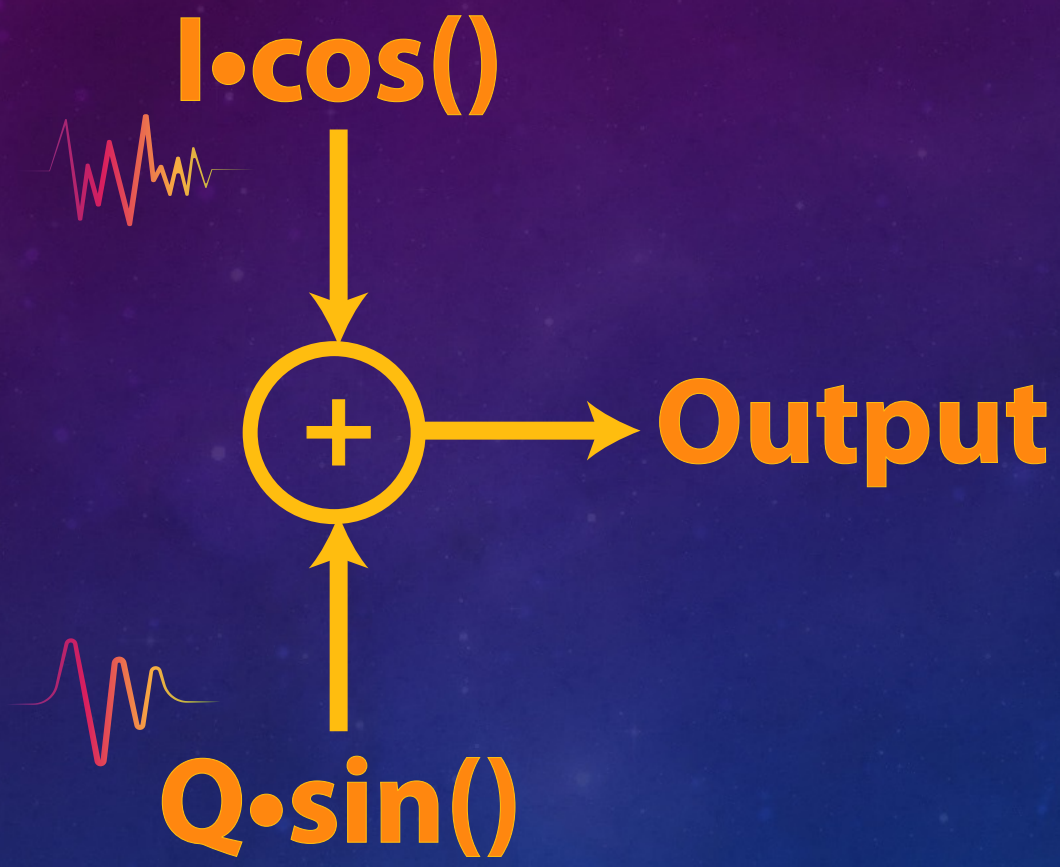
SINUS - I OG Q



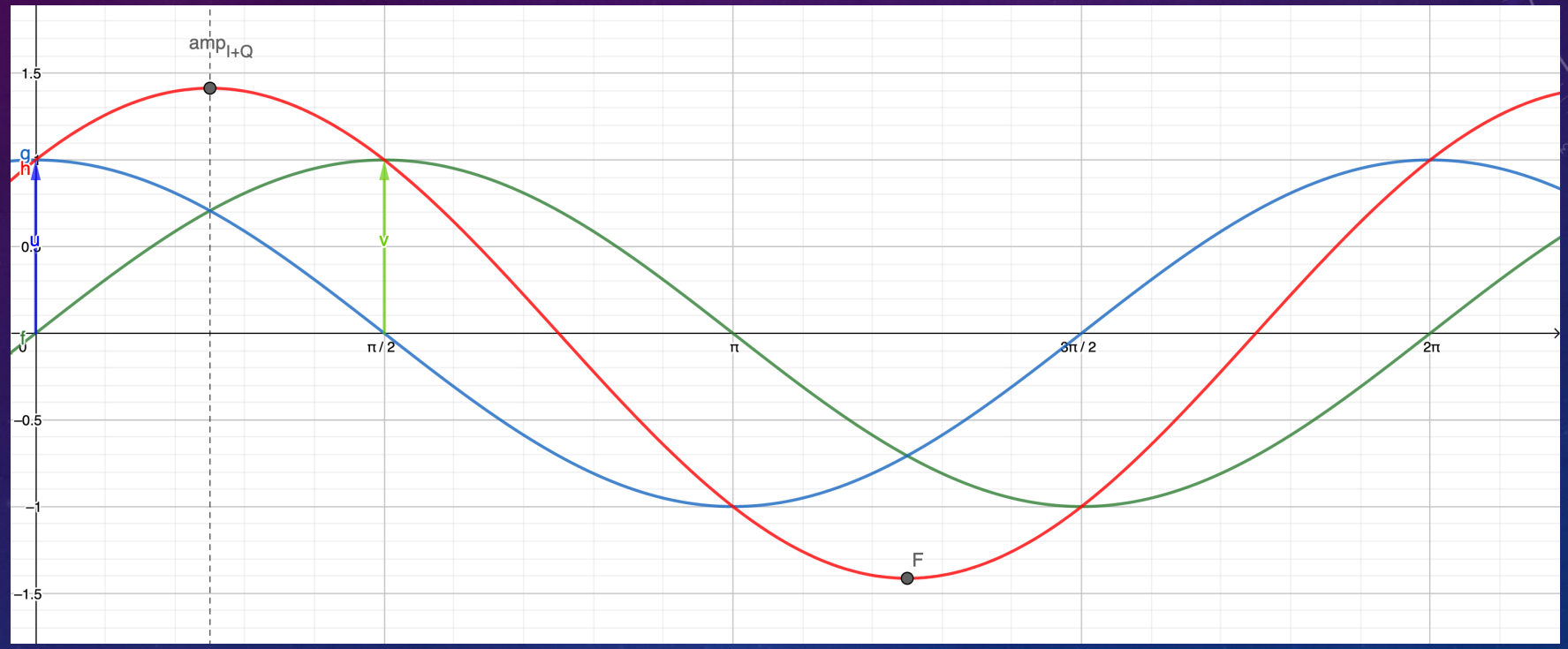
COSINUS OG SINUS



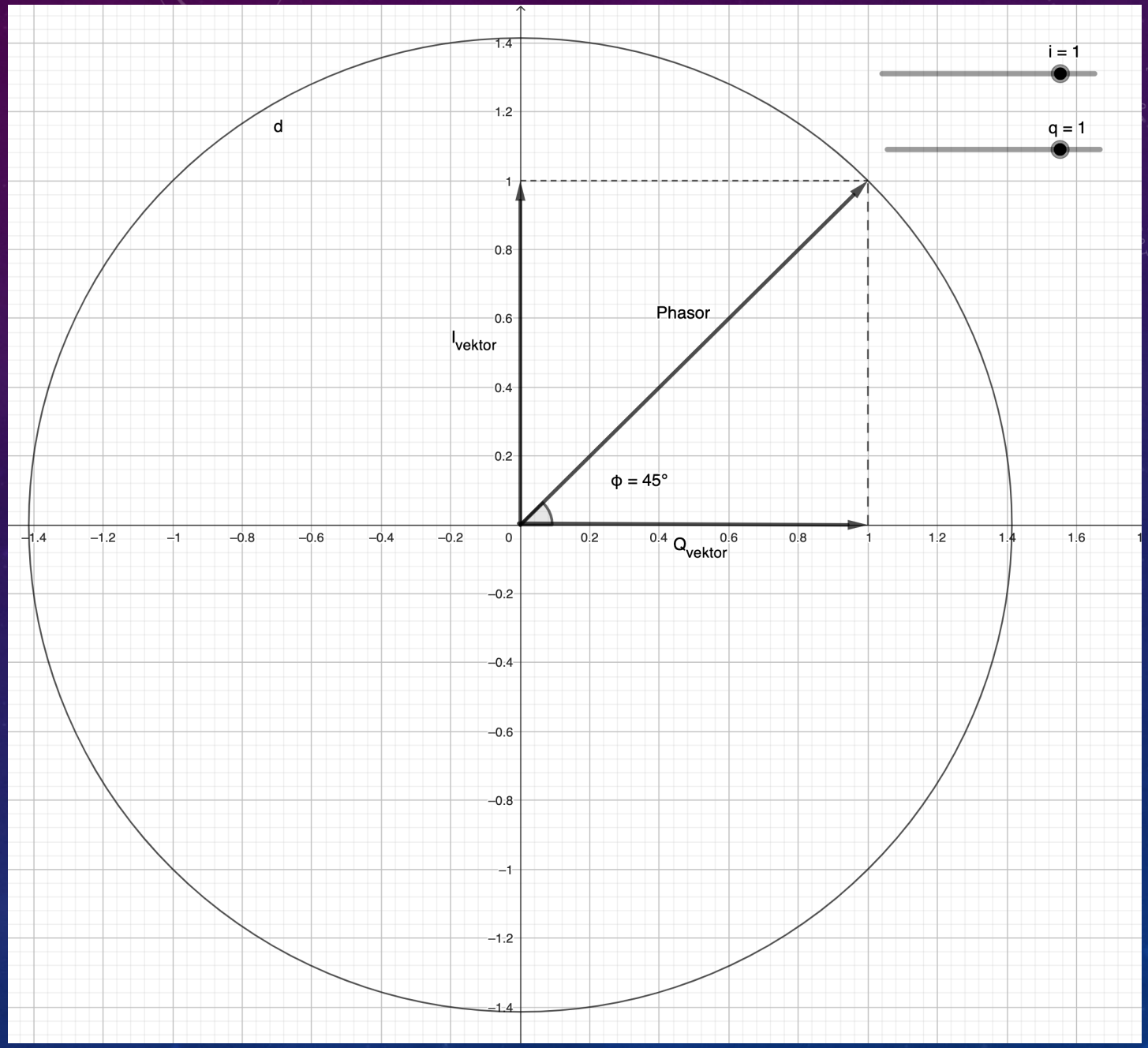
MIXER



COSINUS OG SINUS - I + Q



PHASOR



FASE OG FREKVENS

$$\omega = \frac{d\varphi}{dt}$$

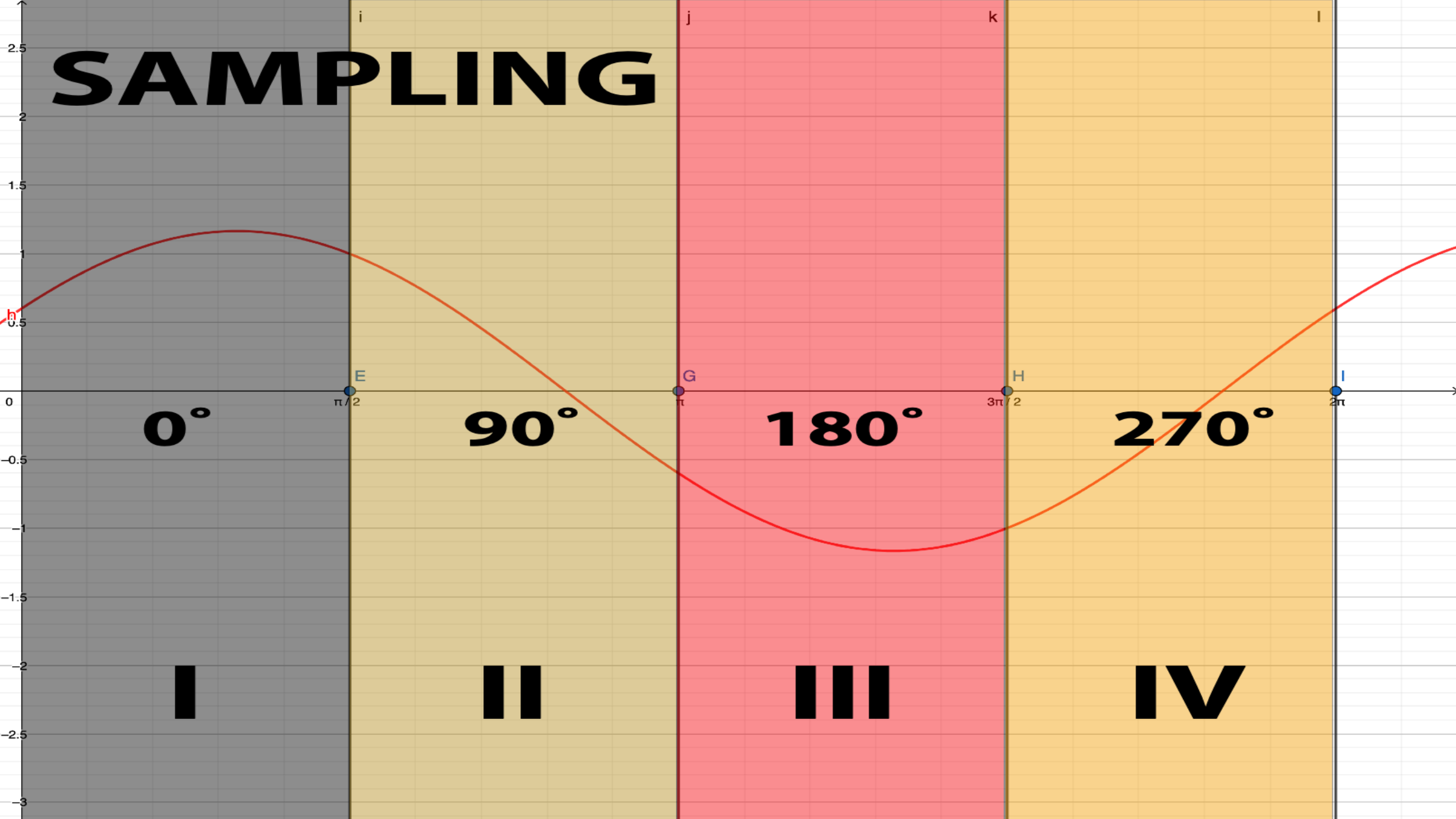
$$\Updownarrow$$

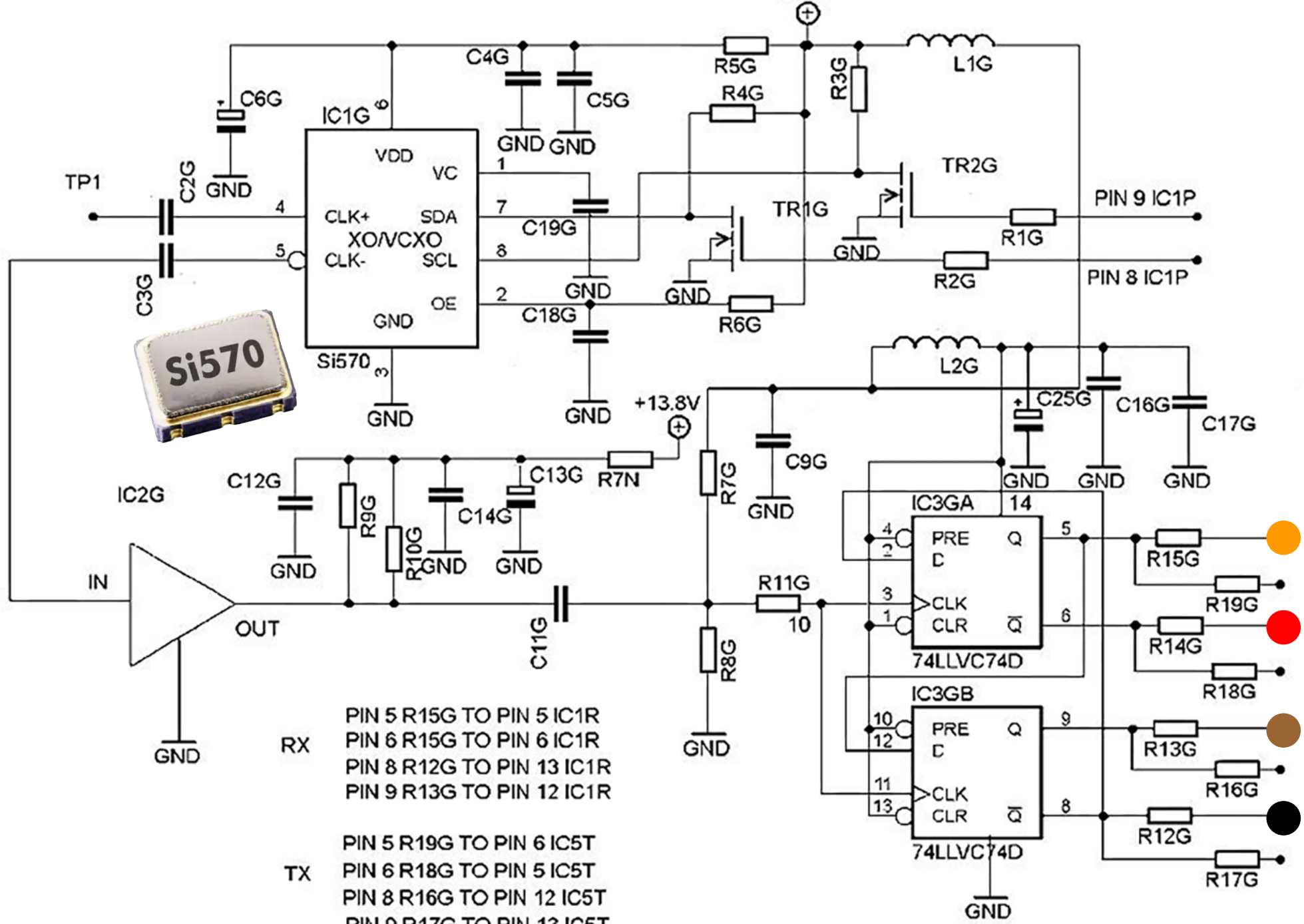
$$2\pi f = \frac{d\varphi}{dt}$$

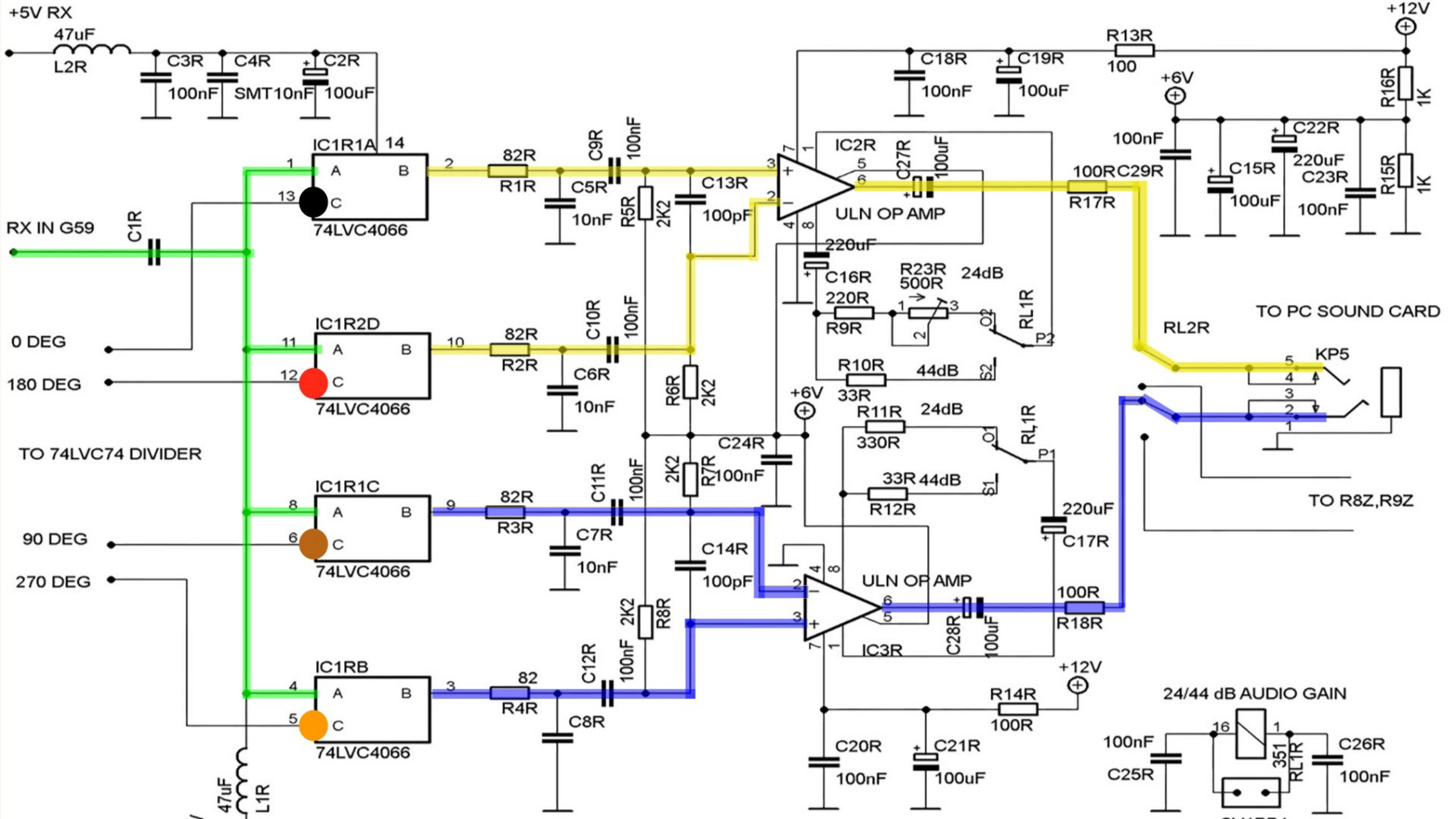
$$\Updownarrow$$

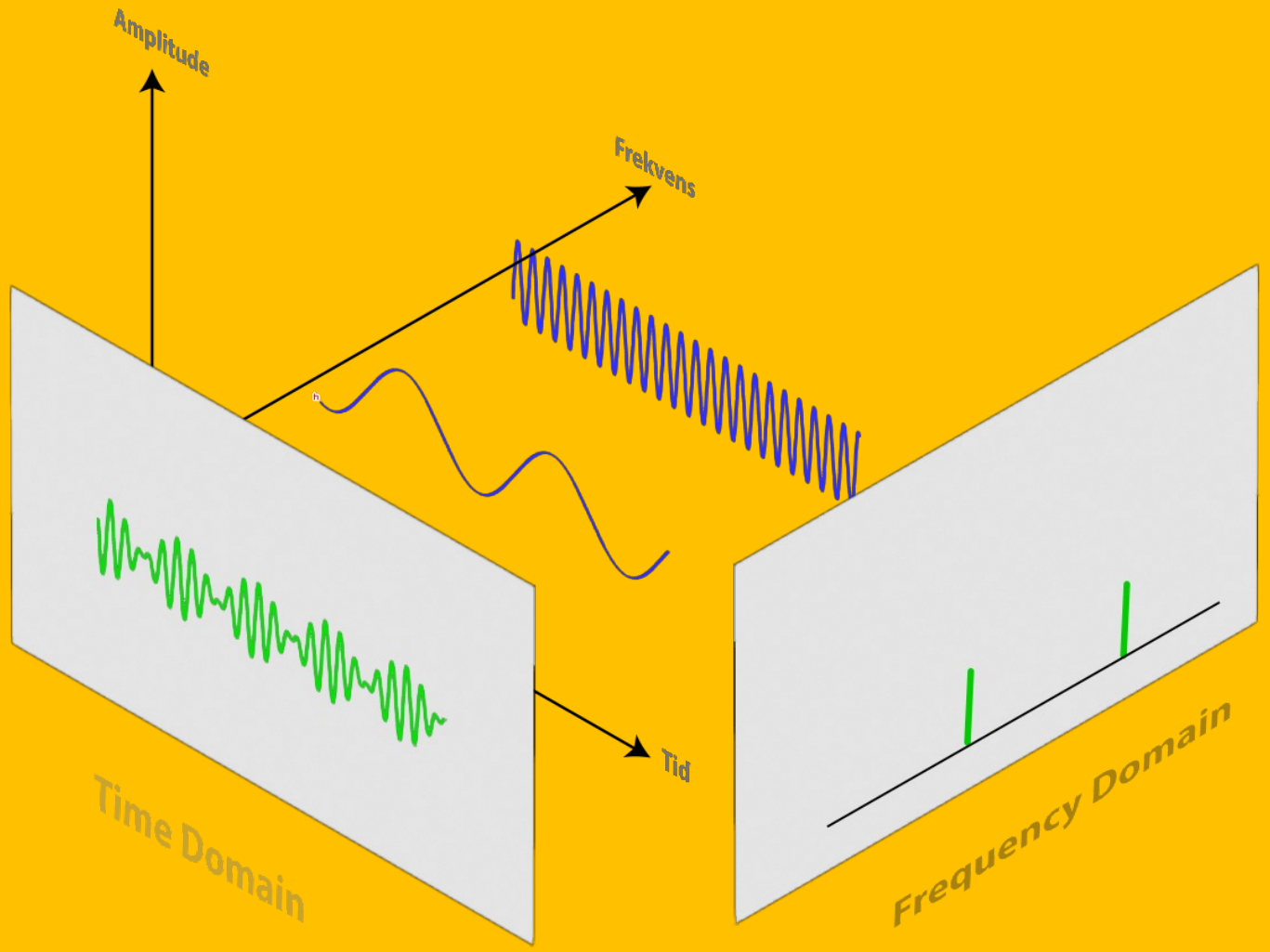
$$f = \frac{1}{2\pi} \circ \frac{d\varphi}{dt}$$

DIRECT CONVERSION


SAMPLING
i
j
k
l
E
G
H
I
π / 2
π
3π / 2
2π
0°
90°
180°
270°
I
II
III
IV

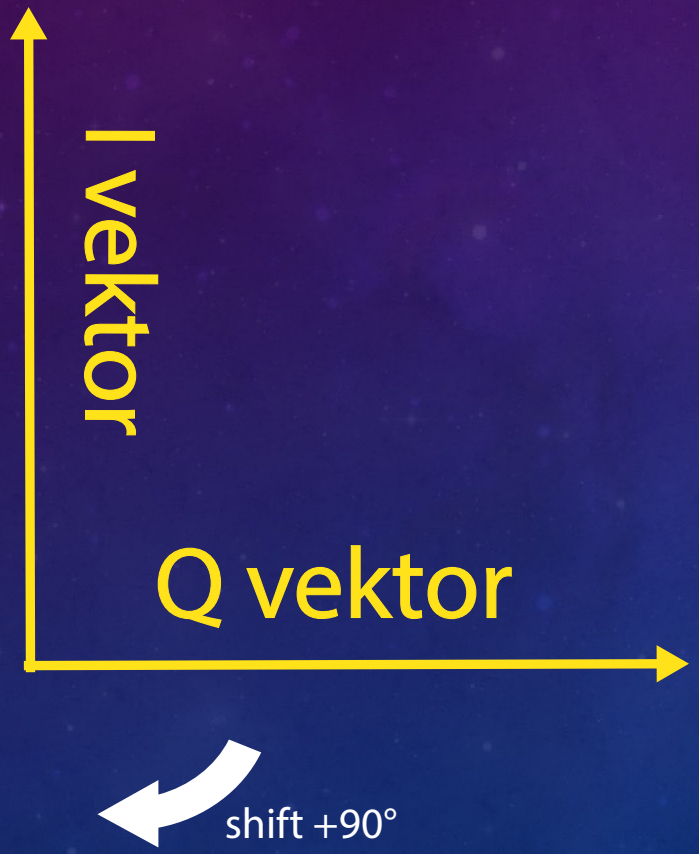

C4G
C5G
R5G
R4G
R3G
L1G
C6G
IC1G
VDD
VC
CLK+
SDA
XO/VCXO
CLK-
SCL
OE
GND
Si570
TP1
C2G
C3G
C19G
C18G
R6G
TR1G
TR2G
R1G
R2G
PIN 9 IC1P
PIN 8 IC1P
L2G
C25G
C16G
C17G
+13.8V
R7N
R7G
C9G
IC2G
C12G
R9G
R10G
C14G
C13G
IN
OUT
C11G
R11G
R8G
IC3GA
IC3GB
PRE
CLK
CLR
74LLVC74D
R15G
R19G
R14G
R18G
R13G
R16G
R12G
R17G
RX
PIN 5 R15G TO PIN 5 IC1R
PIN 6 R15G TO PIN 6 IC1R
PIN 8 R12G TO PIN 13 IC1R
PIN 9 R13G TO PIN 12 IC1R
TX
PIN 5 R19G TO PIN 6 IC5T
PIN 6 R18G TO PIN 5 IC5T
PIN 8 R16G TO PIN 12 IC5T
PIN 9 R17G TO PIN 13 IC5T


+5V RX
47uF
L2R
C3R
100nF
C4R
SMT10nF
C2R
100uF
IC1R1A
74LVC4066
RX IN G59
C1R
0 DEG
180 DEG
IC1R2D
74LVC4066
TO 74LVC74 DIVIDER
IC1R1C
74LVC4066
90 DEG
270 DEG
IC1RB
74LVC4066
47uF
L1R
82R
R1R
C9R
100nF
C5R
10nF
R5R
2K2
C13R
100pF
82R
R2R
C10R
100nF
C6R
10nF
R6R
2K2
82R
R3R
C11R
100nF
C7R
10nF
2K2
R8R
82
R4R
C12R
100nF
C8R
C24R
100nF
2K2
R7R
C14R
100pF
IC2R
ULN OP AMP
C18R
100nF
C19R
100uF
R13R
100
+12V
+6V
C22R
220uF
C23R
100nF
C15R
100uF
100nF
R16R
1K
R15R
1K
C27R
100uF
100R
R17R
C29R
220uF
C16R
220R
R9R
R23R
500R
24dB
RL1R
P2
R10R
33R
44dB
S2
R11R
330R
24dB
O1
RL1R
P1
33R
R12R
44dB
S1
220uF
C17R
IC3R
ULN OP AMP
C28R
100uF
100R
R18R
R14R
100R
C20R
100nF
C21R
100uF
RL2R
TO PC SOUND CARD
KP5
TO R8Z,R9Z
24/44 dB AUDIO GAIN
100nF
C25R
351
RL1R
C26R
100nF

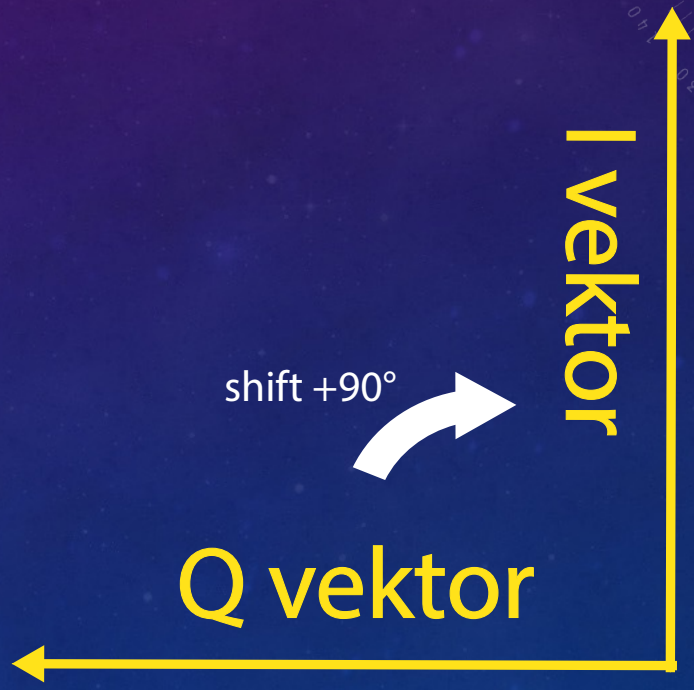

Amplitude
Frekvens
Tid
Time Domain
Frequency Domain

UNDERTRYKKELSE AF SPEJLFREKVENSER

Signaler fra under LO-frekvensen
Q er foran I



Signaler fra over LO-frekvensen
I er foran Q



SDR – HVORFOR?

STØJ

- ALLE ANALOGE KOMPONENTER STØJER. JO FLERE KOMPONENTER, DESTO MERE STØJ.

INTERFERENS

- ANALOGE MIXERE OG OSCILLATORER KAN GIVE FORVRÆNGNING OG INTERMODULATION
- DET SAMME OPSTÅR IKKE VED AT MANIPULERE TAL-DATA.

YDEEVNE

- ANALOGE FILTRE ER VANSKELIGE AT LAVE, OG DE KAN IKKE KONKURRERE PÅ BÅNDBREDDE OG FLANKESTEJLHED. DE KAN DESUDEN FORÅRSAGE RINGNING.
- DET UNDGÅR MAN HELT MED DIGITALE FILTRE. DESUDEN KAN MAN KONSTRUERE DIGITALE FILTRE, SOM PÅ INGEN MÅDE KAN ETABLERES I ANALOG HARDWARE.

FLEKSIBILITET.

- MED DE NYESTE GENERATIONER AF SDR KAN MAN LAVE HARDWARE, SOM MED PASSENDE SOFTWARE KAN KODES TIL MANGE FORSKELLIGE OPGAVER. OG DE KAN OMKODES, SÅ MAN FÅR EN HELT ANDEN TYPE RADIO!

PRIS

- FLEKSIBILITETEN OG LAVE PRODUKTIONSOMKOSTNINGER PÅ DE ANVENDTE CHIPS GØR, AT DET ER VÆSENTLIGT BILLIGERE AT PRODUCERE SDR-TRANSCEIVERE I FORHOLD TIL ANALOGE

SDR GENERATIONER

TIDLIG SDR

- BENYTTER EN TAYLOE-DETEKTOR
- ADC OG DAC BLIVER FORETAGET AF COMPUTERENS LYDKORT
- KONTROL, DSP OG DEMODULATION FORETAGES AF COMPUTEREN

DEN NÆSTE GENERATION

- BENYTTER EN TAYLOE-DETEKTOR
- ADC OG DAC I ONBOARD CHIPS
- KONTROL, DSP OG DEMODULATION FORETAGES AF COMPUTEREN

TREDJE GENERATION

- BENYTTER EN TAYLOE-DETEKTOR
- ADC OG DAC I ONBOARD CHIIPS
- KONTROL, DSP OG DEMODULATION I ONBOARD CHIPS

FJERDE GENERATION

- BENYTTER DDC OG DUC
- HAR FIELD PROGRAMMABLE GATE ARRAY ONBOARD (FPGA)

KILDER 1 AF 2

LINKS

KRYSTALRADIO

- WWW.NUTSVOLTS.COM/MAGAZINE/ARTICLE/REMEMBERING-THE-CRYSTAL-RADIO

GENESIS RADIO

- WEB.ARCHIVE.ORG/WEB/20120305091638/HTTP://GENESISRADIO.COM.AU/G59/
- WWW.YOUTUBE.COM/WATCH?V=FV-SJOV-JVW
- WWW.YOUTUBE.COM/WATCH?V=MIRSOEECJ88

MODULATION

- ARACHNOID.COM/JSIGGEN/INDEX.HTML
- WWW.YOUTUBE.COM/WATCH?V=R04YEKQGGPC
- COMMONS.WIKIMEDIA.ORG/WIKI/FILE%3AAMFM3-EN-DE.GIF
- MAXWELL.SZE.HU/~UNGERT/RADIORENDSZEREK_SATLAB/SEGEDANYAGOK/SZOFTVER/AGILENT_MODULATION/DATA/HTML/SPECAN10.HTML

PASSBAND – BASEBAND

- EBRARY.NET/78615/COMPUTER_SCIENCE/BANDPASS_BASEBAND_EQUIVALENT_TRANSFORMATION

WHY I OG Q

- WIRELESSPI.COM/I-Q-SIGNALS-101-NEITHER-COMPLEX-NOR-COMPLICATED/

KILDER 2 AF 2

LINKS

DFT OG FFT

- PYSDR.ORG/CONTENT/FREQUENCY_DOMAIN.HTML#FAST-FOURIER-TRANSFORM-FFT
- JAKEVDP.GITHUB.IO/BLOG/2013/08/28/UNDERSTANDING-THE-FFT/
- DSP.STACKEXCHANGE.COM/QUESTIONS/17579/NUMBER-OF-DFT-FFT-POINTS-REQUIRED-FOR-A-SPECIFIC-FREQUENCY-RESOLUTION-FOR-AN-O
- ELECTRONICS.STACKEXCHANGE.COM/QUESTIONS/303346/WHAT-DO-WE-MEAN-BY-FFT-POINTS
- JAKEVDP.GITHUB.IO/BLOG/2013/08/28/UNDERSTANDING-THE-FFT/

NØRD: FASE OG FREKVENS

- DSP.STACKEXCHANGE.COM/QUESTIONS/73450/FROM-IQ-SIGNAL-TO-FM-MODULATED-CARRIER-HOW-ITS-DONE

BØGER

- MARTIN EWING: WHY YOUR NEXT RADIO WILL BE SDR
- ANDREW BARRON: SDR SOFTWARE DEFINED RADIO

EKSTRAMATERIALE

HVIS VI SKAL ET SPADESTIK DYBERE I FORHOLD TIL

FAST FOURIER TRANSFORMATIONER

Fast Fourier Transformation

```
def FFT(x):
    """A recursive implementation of the 1D Cooley-Tukey FFT"""
    x = np.asarray(x, dtype=float)
    N = x.shape[0]

    if N % 2 > 0:
        raise ValueError("size of x must be a power of 2")
    elif N <= 32:  # this cutoff should be optimized
        return DFT_slow(x)
    else:
        X_even = FFT(x[::2])
        X_odd = FFT(x[1::2])
        factor = np.exp(-2j * np.pi * np.arange(N) / N)
        return np.concatenate([X_even + factor[:N / 2] * X_odd,
                               X_even + factor[N / 2:] * X_odd])
```

Fast Fourier Transformation

DFT

Hvis der er n observationer i et datasæt, kræves der n•n operationer for at udregne Discrete Fourier Transformation.

FFT

Ved at konstruere algoritmer, som arbejder på henholdsvis lige og ulige tal, kan man dele Discrete Fourier Tranformation op i to dele. Under anvendelse af nogle symmetribetragtninger kan man vise, at antallet af operationer kan begrænses til n • log(n).

Fast Fourier Transformation

WolframAlpha computational intelligence

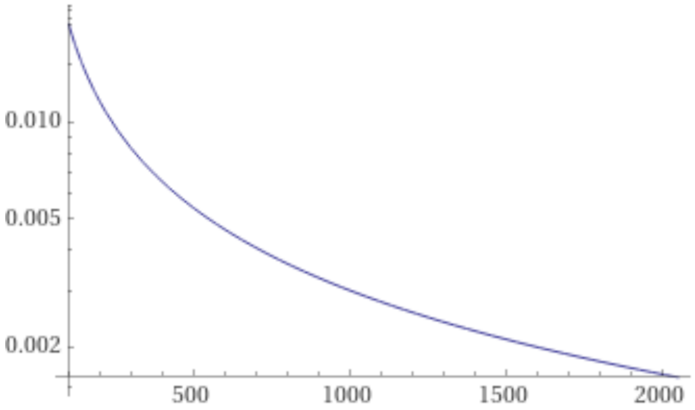
Input interpretation

log plot	$\left\lvert \frac{x \log_{10}(x)}{x^2} \right\rvert$	$x = 100$ to 2050

$\log_b(x)$ is the base-b logarithm

$|z|$ is the absolute value of z

Log plot



(x from 100 to 2050)

DIRECT CONVERSION