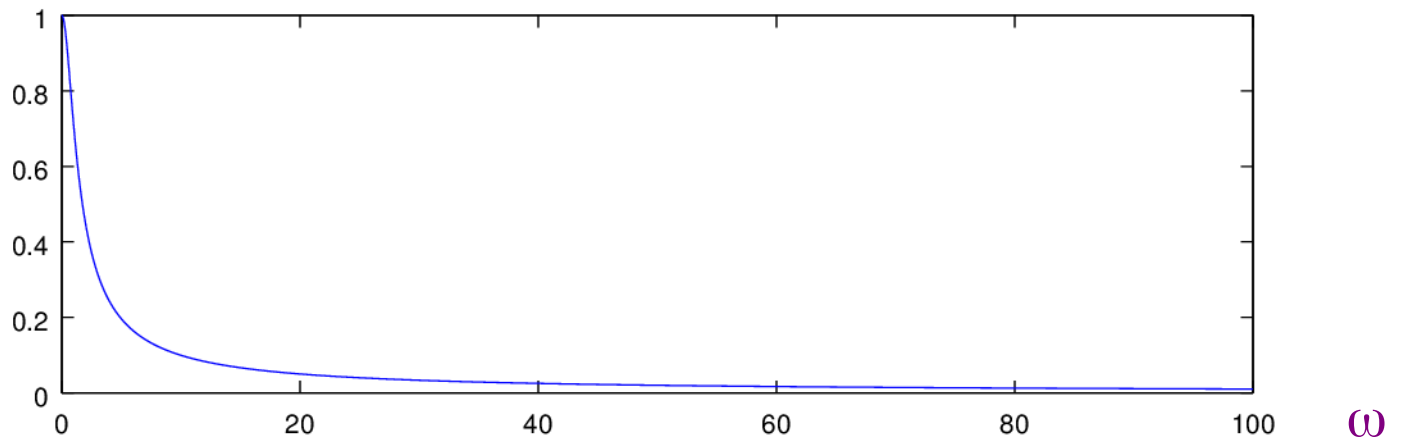
Nyquist Plot (3A)

Please send corrections (or suggestions) to youngwlim@hotmail.com.

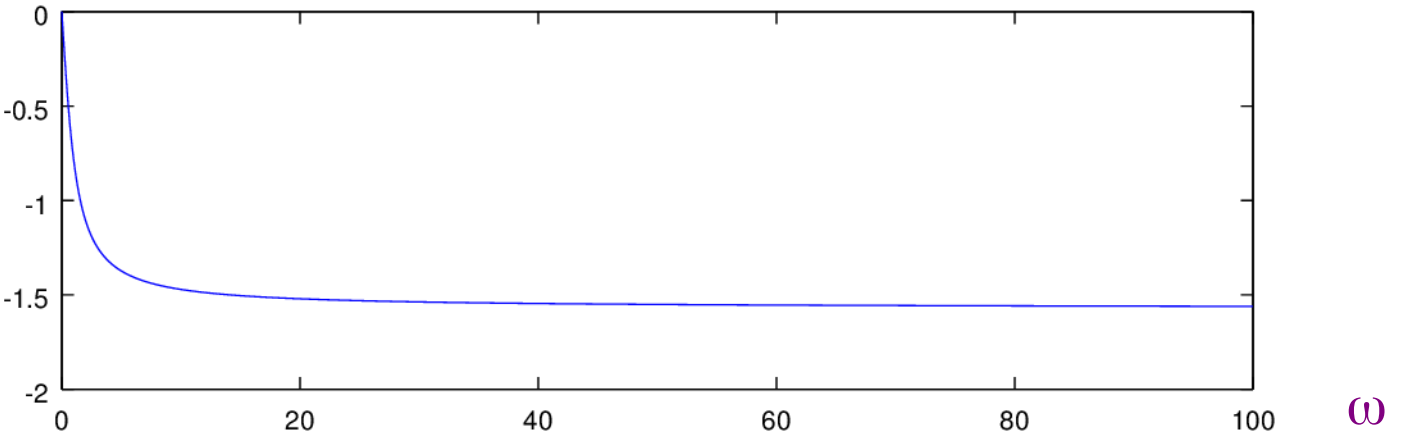
This document was produced by using OpenOffice and Octave.

Frequency Response of G(s) = 1 / (s + 1)

$$\left| \frac{1}{(j\omega+1)} \right|$$

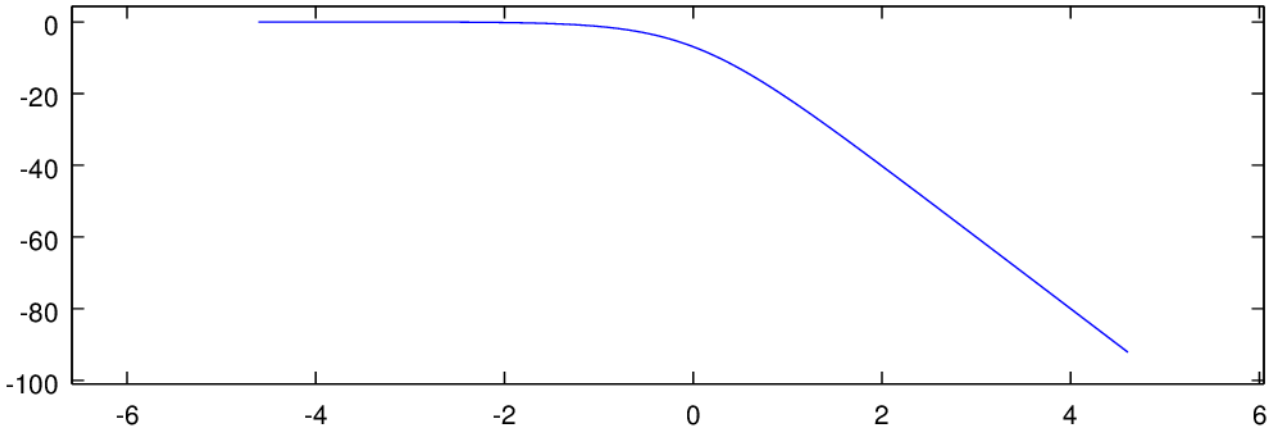


$$arg\left\{ \frac{1}{(j\omega+1)} \right\}$$



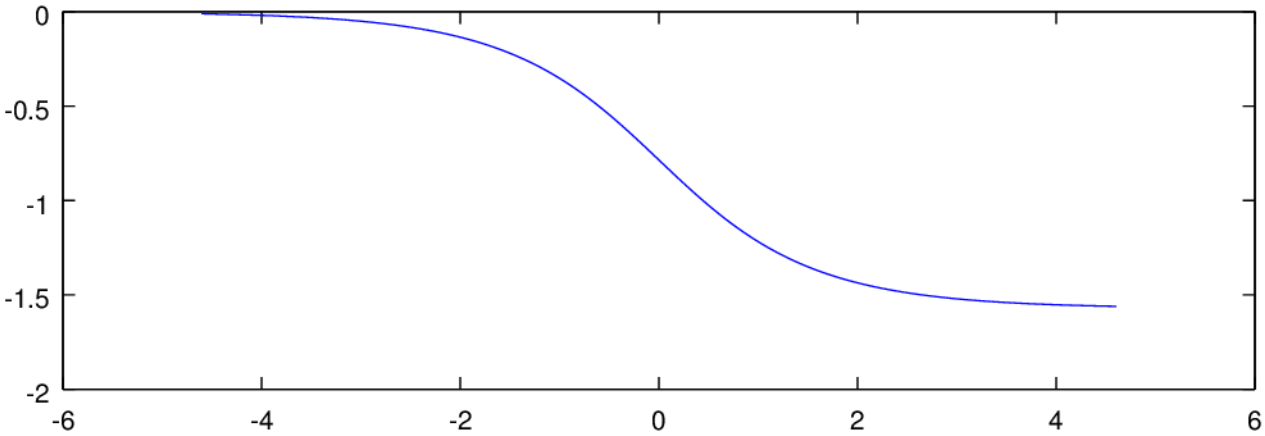
Bode Plot

$$20\log\left|\frac{1}{(j\omega+1)}\right|$$



$\log(\omega)$

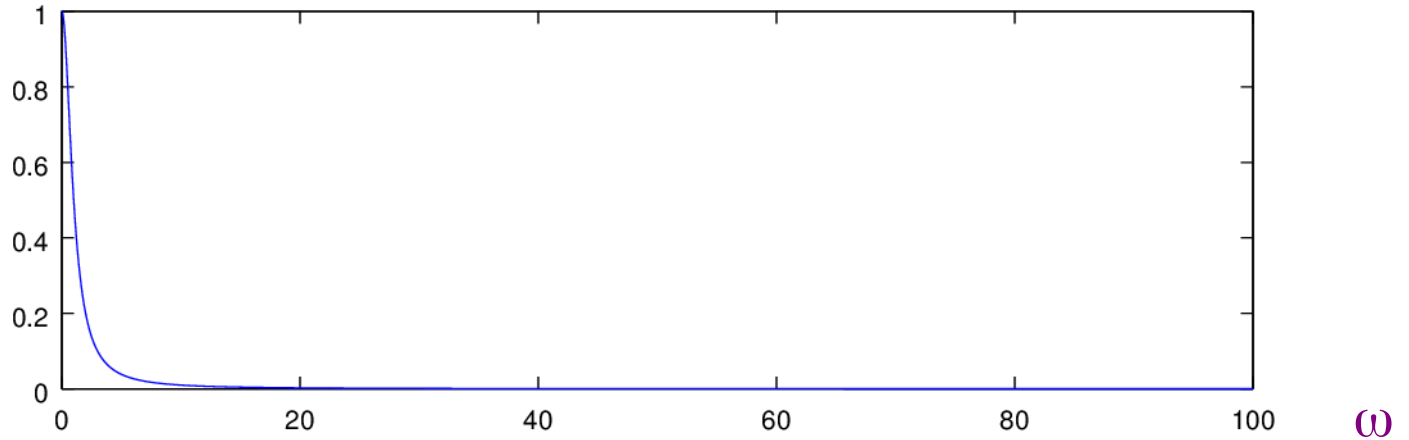
$$arg\left\{\frac{1}{(j\omega+1)}\right\}$$



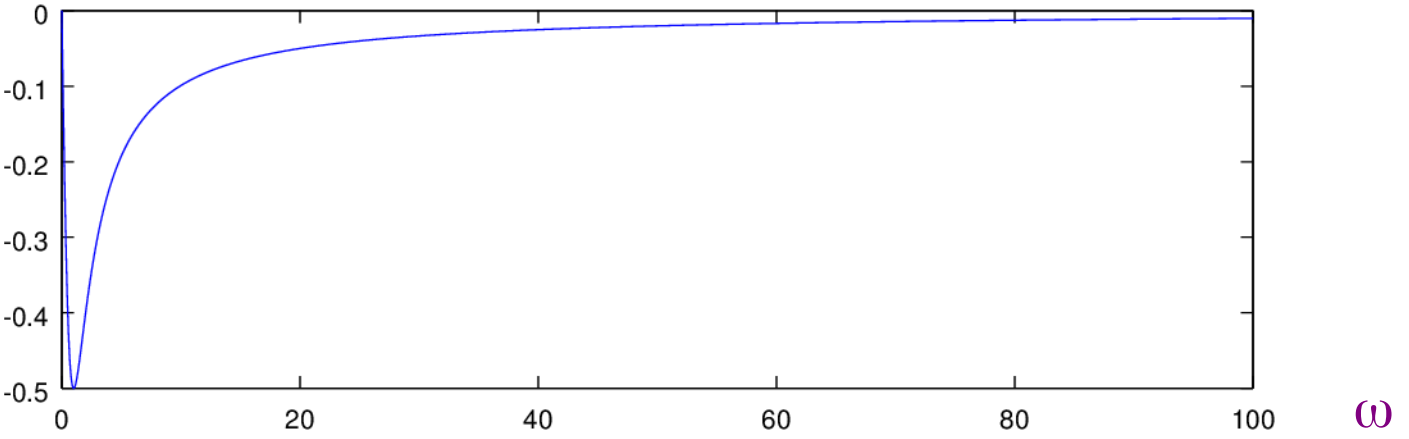
$\log(\omega)$

Real and Imaginary Part of G(jω)

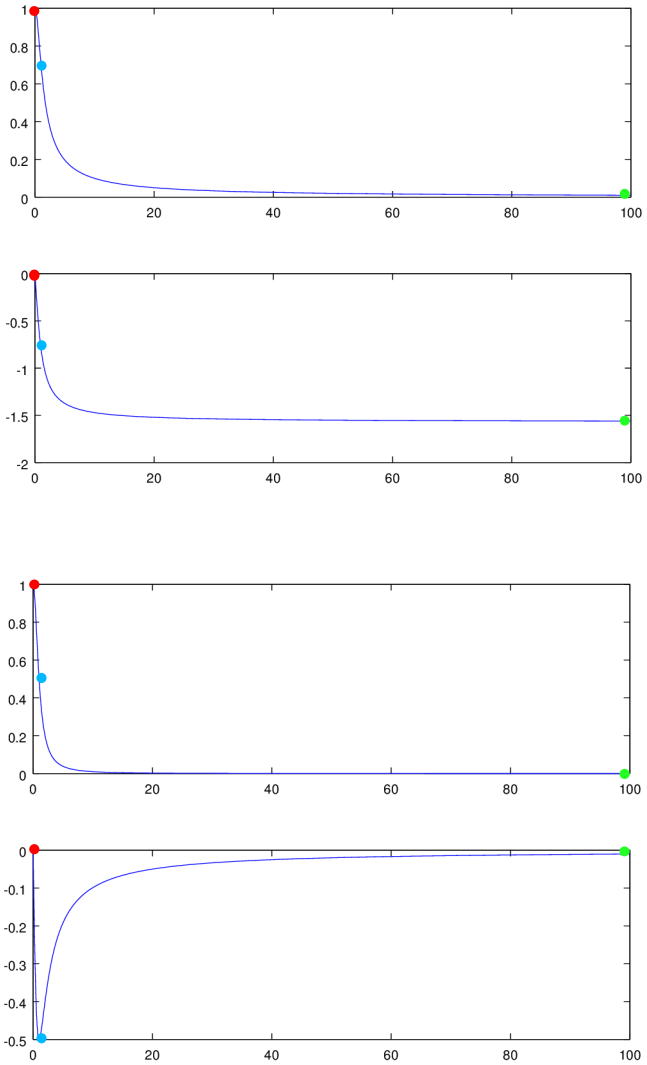
$$\Re\left\{\frac{1}{(j\omega+1)}\right\}$$



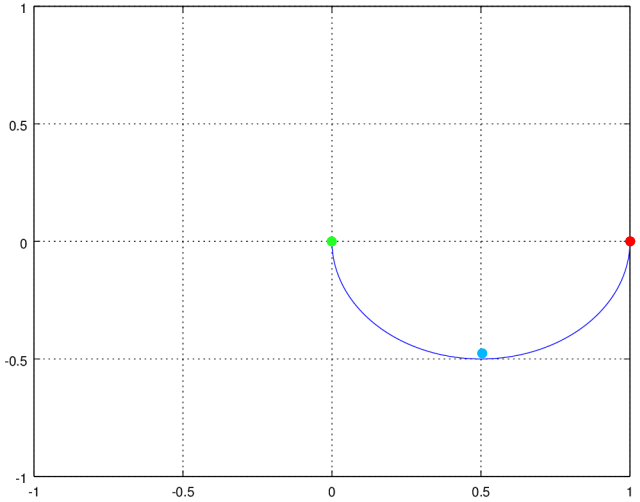
$$\Im\left\{\frac{1}{(j\omega+1)}\right\}$$



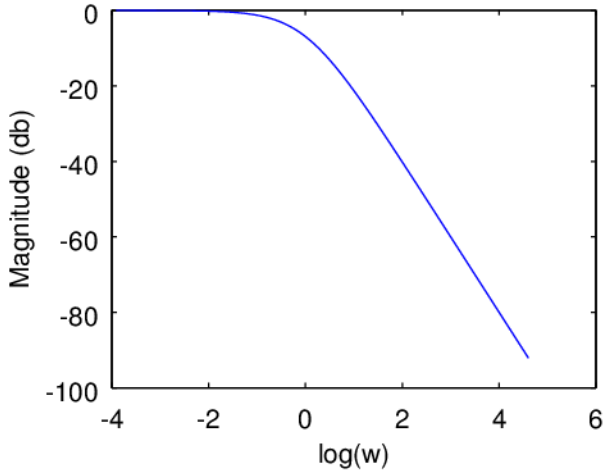
Nyquist Plot

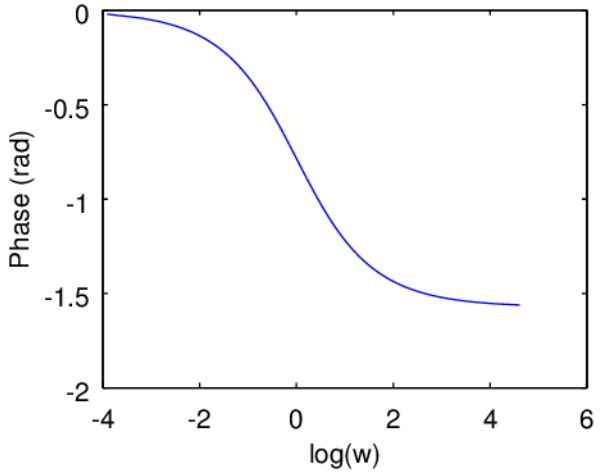



```
w = linspace(0, 1000, 10000);
G = 1 ./ (i*w + 1);
m = abs (G);
a = arg(G);
x = real(G);
y = imag(G);
plot(w, m); plot(w, a);
plot(w, x); plot(w, y);
plot(log(w), 20*log(m)); plot(log(w), a);
plot(x, y);
```

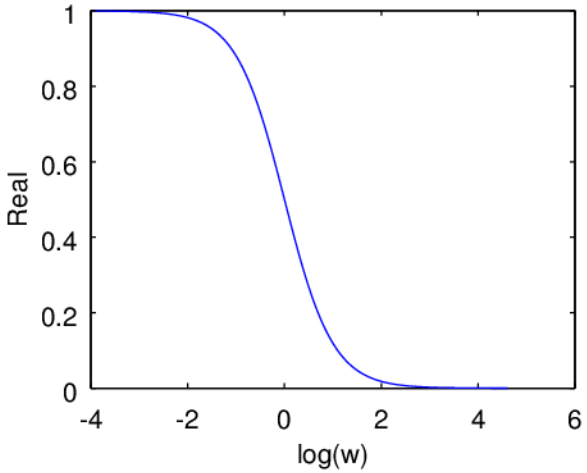


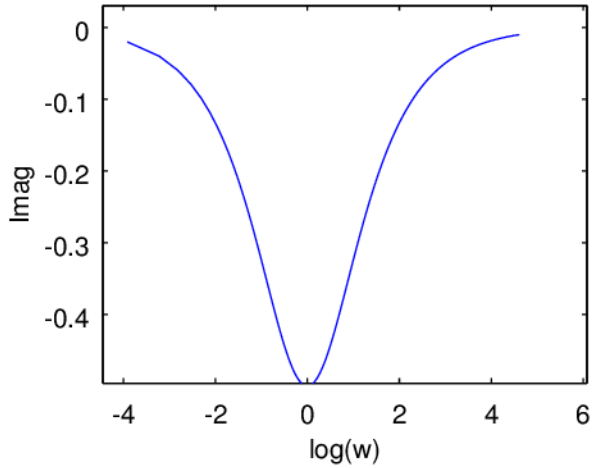
Nyquist Plot

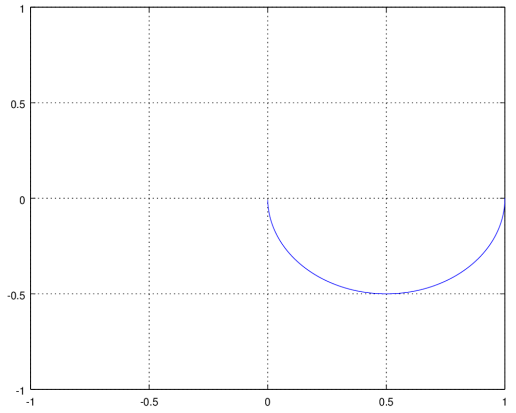




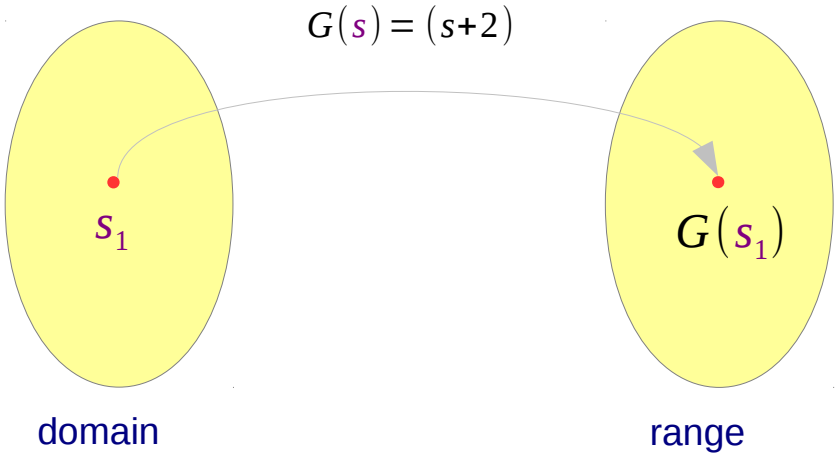

```
w = linspace (0, 100, 5000);
G = 1 ./ (i*w + 1);
m = abs(G);
a = arg(G);
x = real(G);
y = imag(G);

subplot(2, 2, 1);
plot(log(w), 20*log(m));
subplot(2, 2, 2);
plot(log(w), a);
subplot(2, 2, 3); plot(log(w), x);
subplot(2, 2, 4); plot(log(w), y);
```

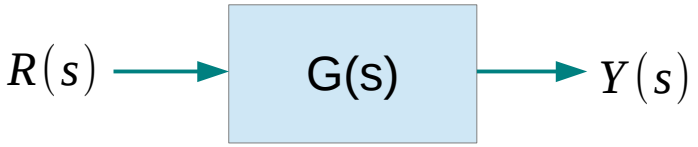






Transfer Function as a Complex Function (1)

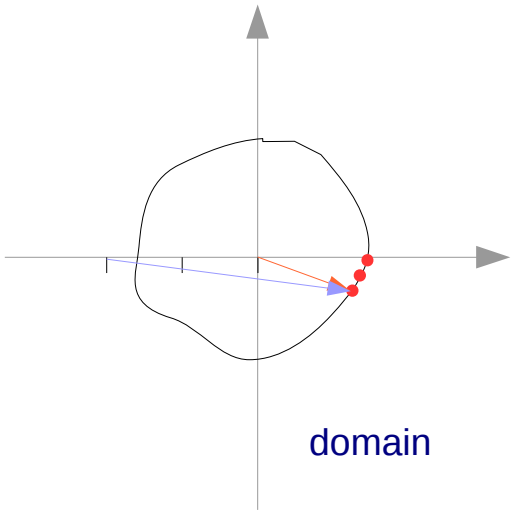


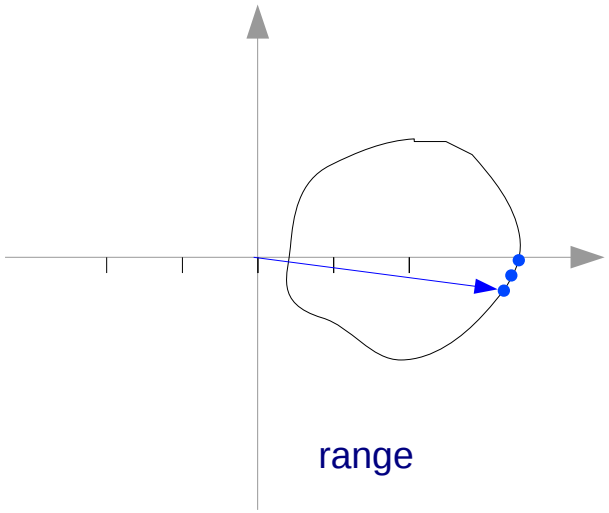


a vector : s

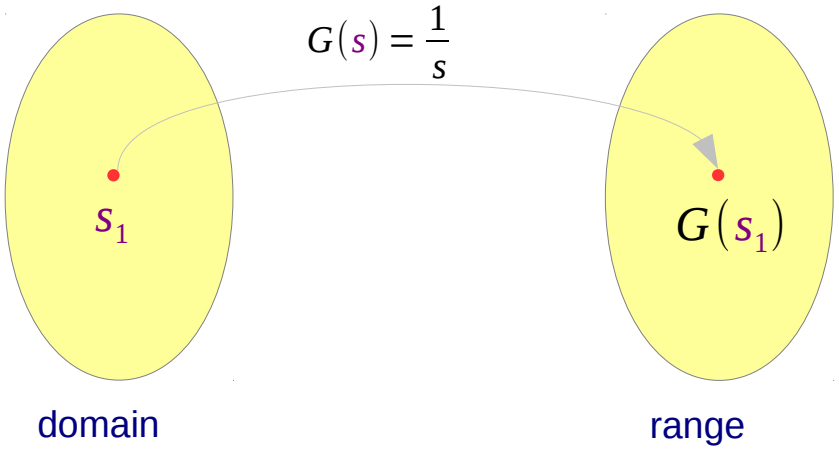
a mapped vector : $(s+2) = s-(-2)$

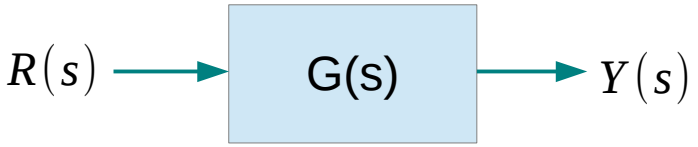
assuming zero at -2





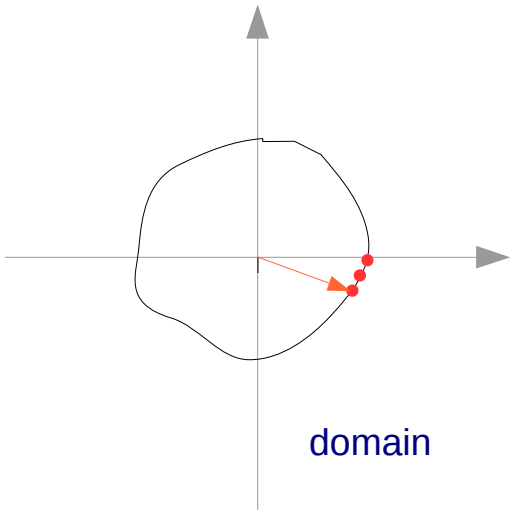
Transfer Function as a Complex Function (2)

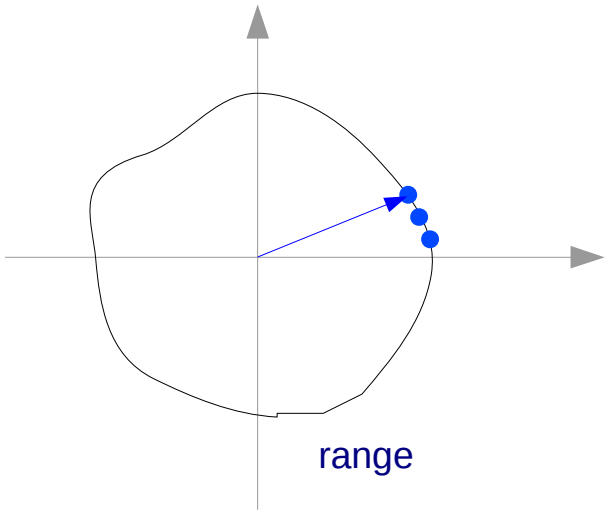




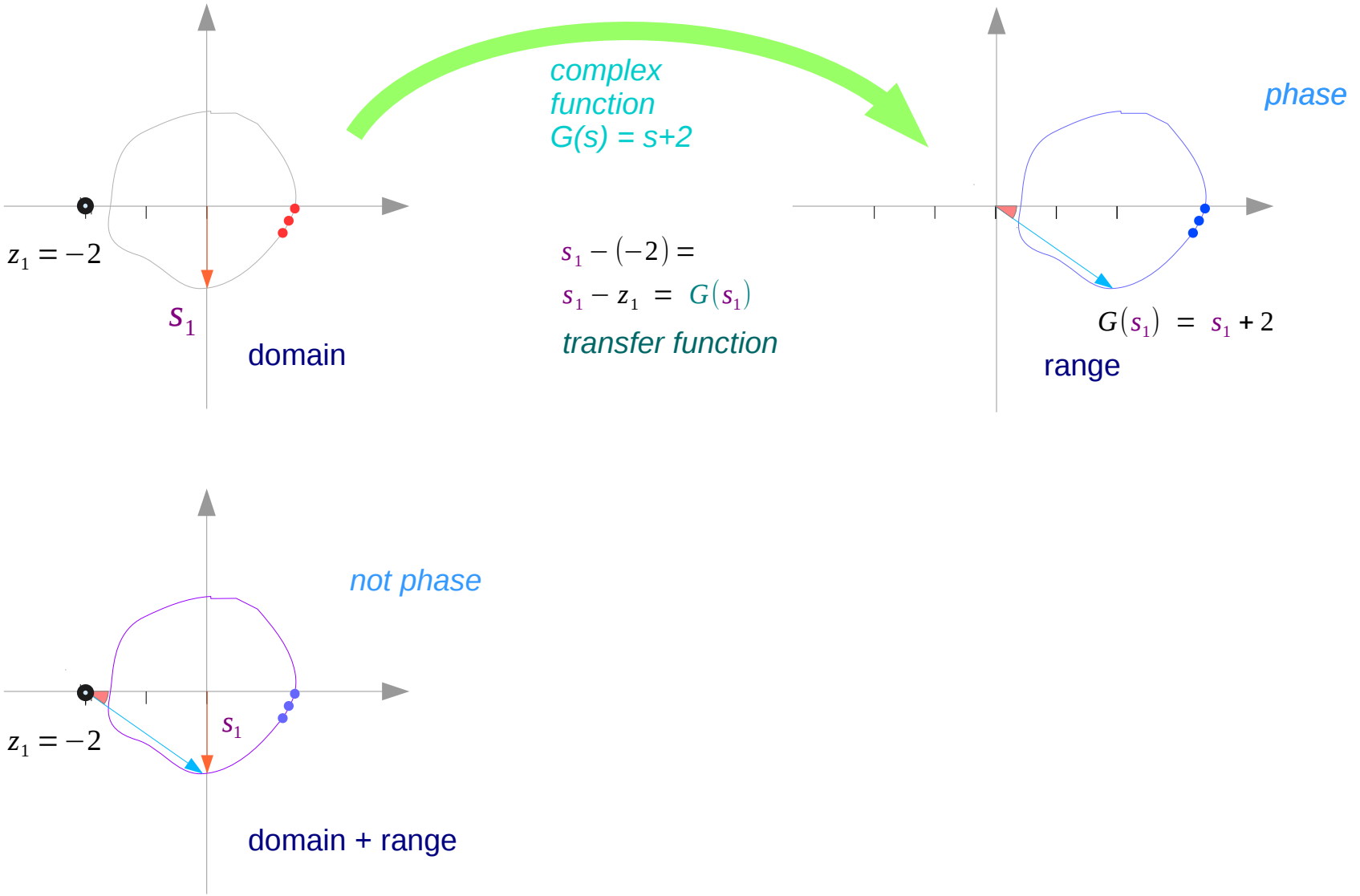
a vector : s

the reciprocal of a mapped vector : $(s+0) = s-(0)$ *assuming pole at* 0

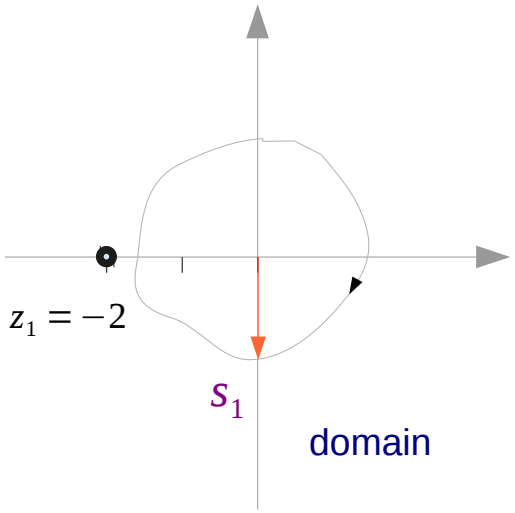


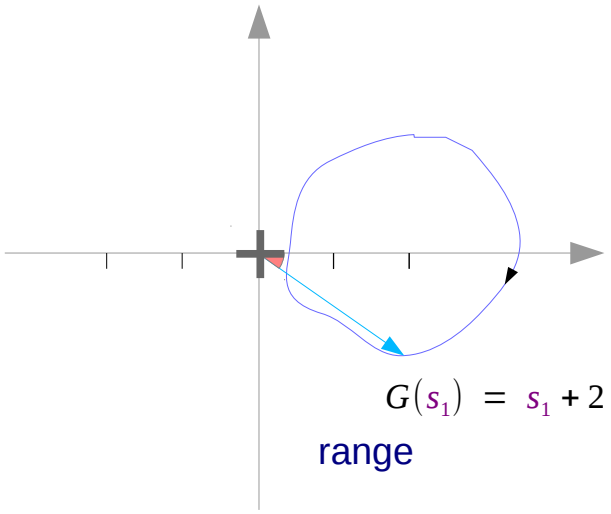


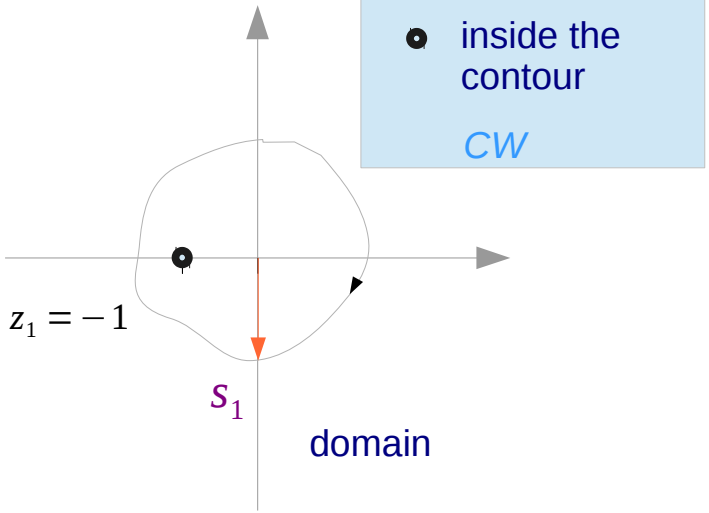
Contour Mapping

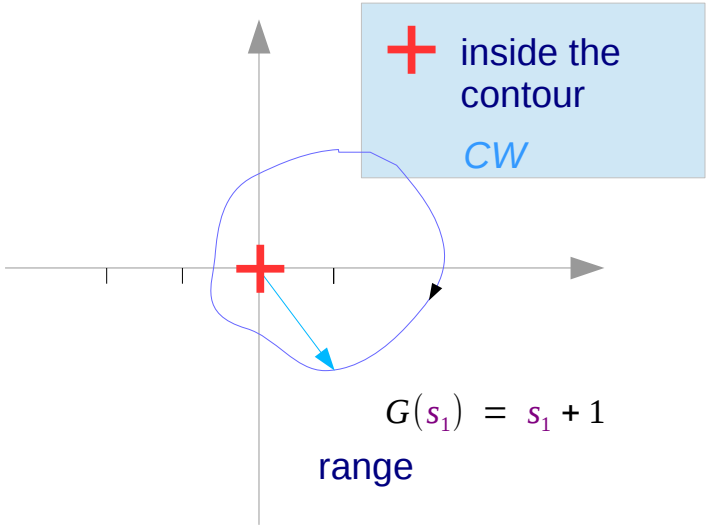


Contour Mapping

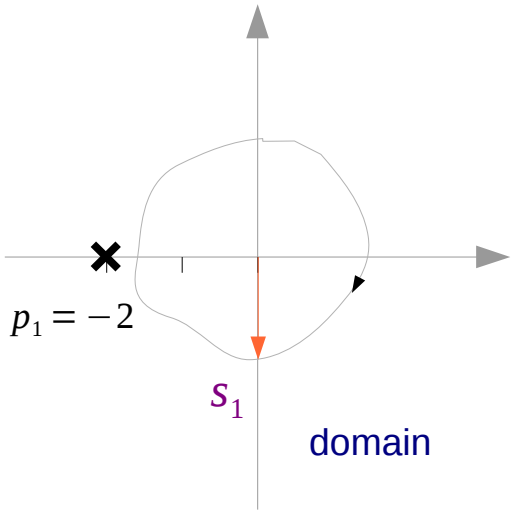


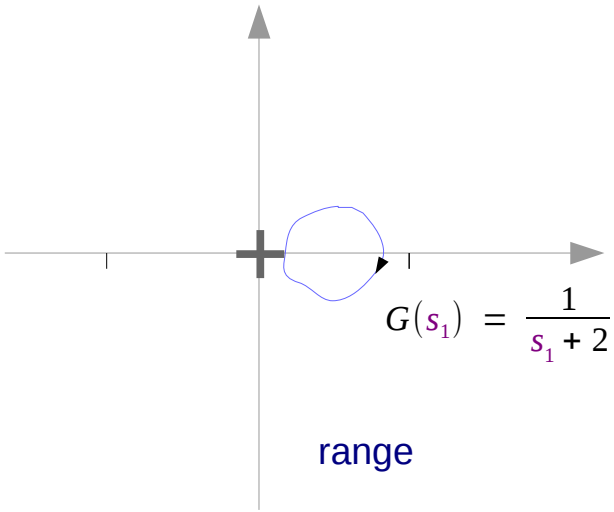


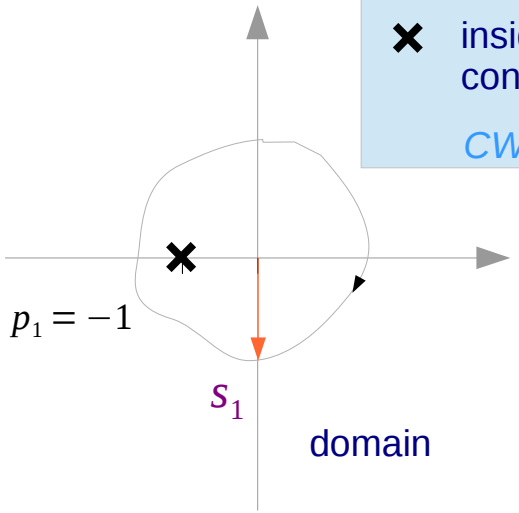




Contour Mapping

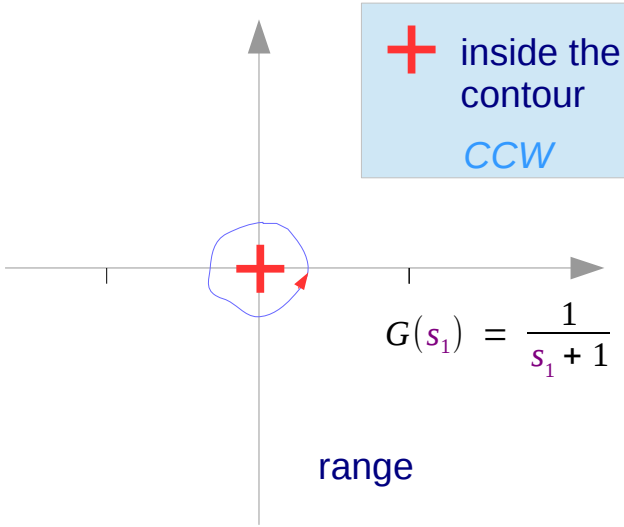






× inside the contour

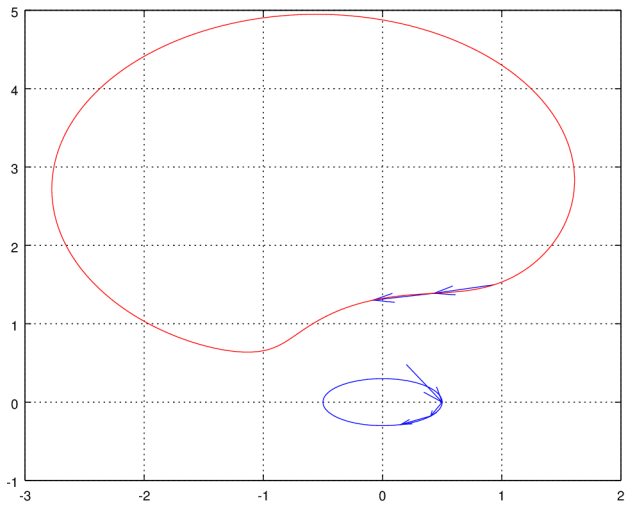
CW

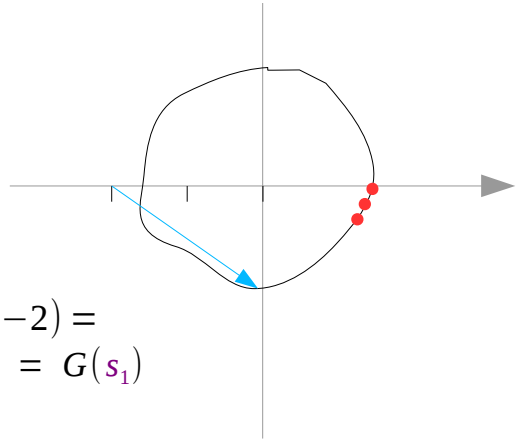


\+ inside the contour

CCW

Contour Mapping

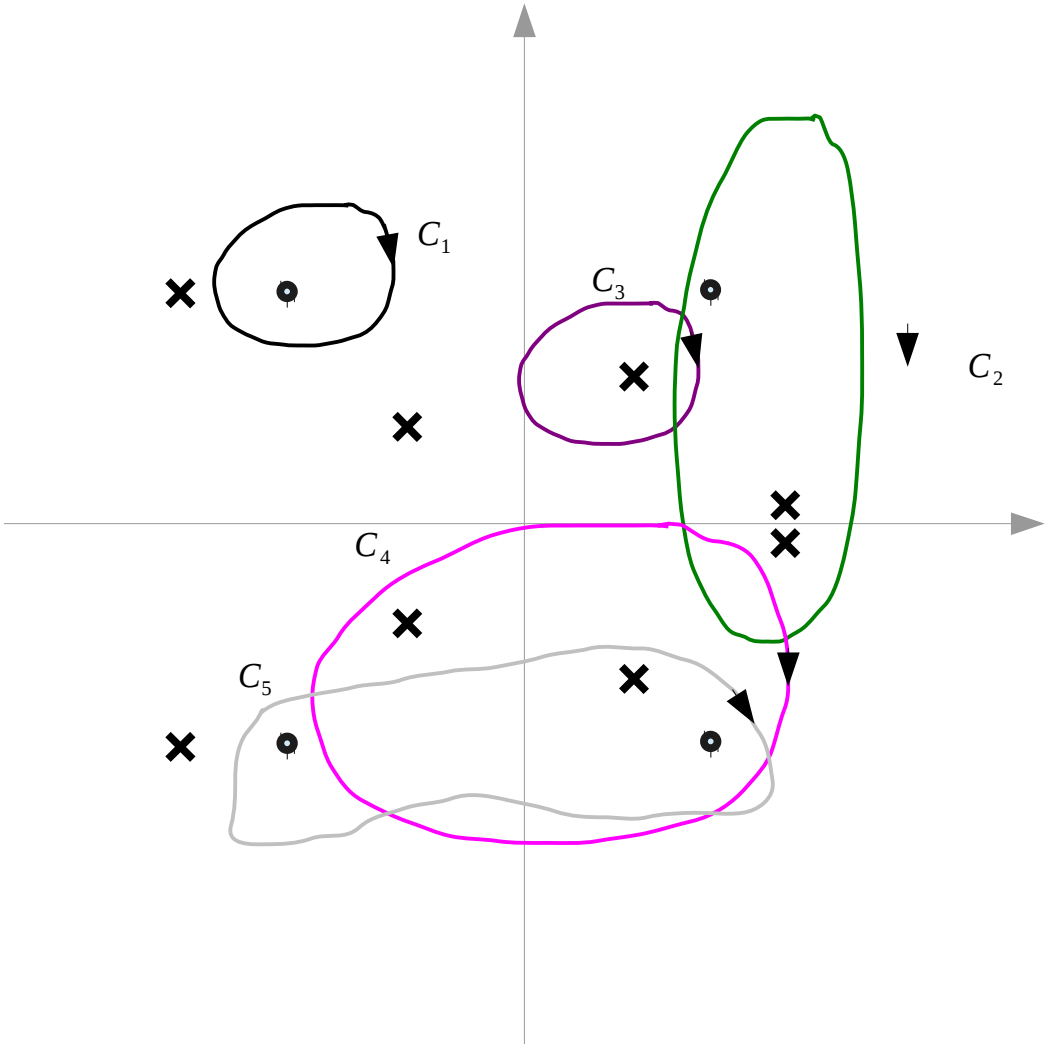




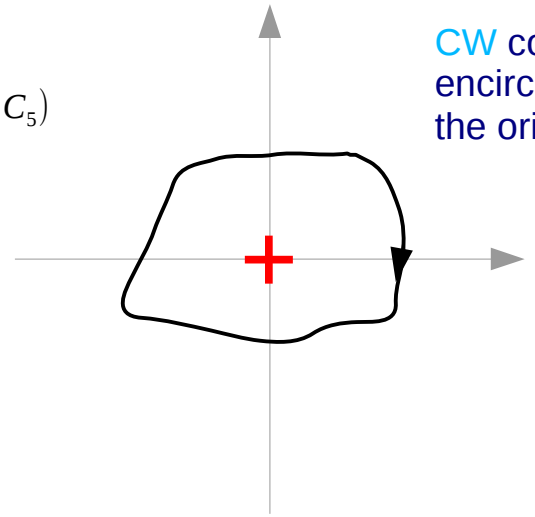
$s_1 - (-2) =$
$s_1 + 2 = G(s_1)$

```
clf;old off;
t = linspace(0, 2*pi, 1000);
cx = 0.0;
cy = 0.0;
x = 0.5*cos(-t) + cx;
y = 0.3*sin(-t) + cy;
s = x + i*y;
px = -0.2;
py = -0.48;
z = 1 ./ (s + px + i *py);
xx = real(z);
yy = imag(z);
grid on;
hold on;
quiver(xx(1), yy(1), -xx(1)+xx(101), -yy(1)+yy(101))
quiver(xx(101), yy(101), -xx(101)+xx(201), -yy(101)+yy(201))
quiver(x(1),   y(1),   -x(1)+x(101),   -y(1)+y(101))
quiver(x(101), y(101), -x(101)+x(201), -y(101)+y(201))
quiver(-px,   -py,   x(1)+px,   y(1)+py)
plot(x, y, 'b');
plot(xx, yy, 'r');
```

Contour Mapping

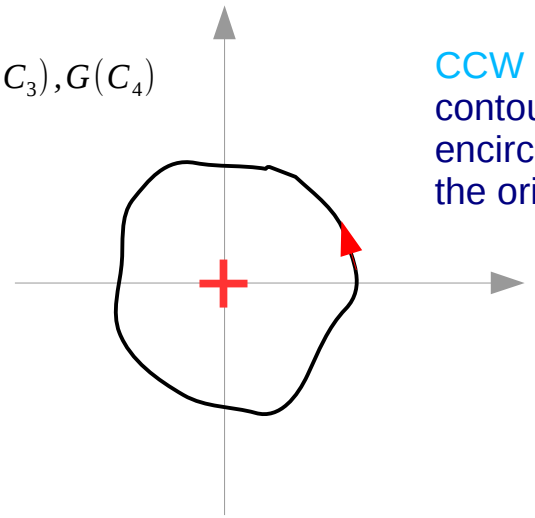


$G(C_1), G(C_5)$



CW contour encircling the origin 0

$G(C_2), G(C_3), G(C_4)$



CCW contour encircling the origin 0

References

[1] http://en.wikipedia.org/
[2] M.L. Boas, “Mathematical Methods in the Physical Sciences”
[3] E. Kreyszig, “Advanced Engineering Mathematics”
[4] D. G. Zill, W. S. Wright, “Advanced Engineering Mathematics”