**EJERCICIOS MATLAB**

**NÚMEROS COMPLEJOS**

2.1

1

>> z = (1-exp(pi\*i/2))/(1+exp(pi\*i/2))

z =

-0.0000 - 1.0000i Binómica

>> w=exp(pi\*i)\*(1-exp(-pi\*i/3))

w =

-0.5000 - 0.8660i

2

>> conjW=conj(w)

conjW =

-0.5000 + 0.8660i

>> suma=z+conjW

suma =

-0.5000 - 0.1340i

>> u=(suma/2\*i)+0.5

u =

0.5670 - 0.2500i

>> modulo=abs(u)

modulo =

0.6197

>> angle(u)

ans =

-0.4153

>> real = real(u)

real =

0.5670

>> imaginaria=imag(u)

imaginaria =

-0.2500

2.2

1

>> z=1+i

z =

1.0000 + 1.0000i

>> w=1-sqrt(3)\*i

w =

1.0000 - 1.7321i

>> modZ=abs(z) Módulos

modZ =

1.4142

>> modW=abs(w)

modW =

2.0000

>> argZ = sym(angle(z)) Argumentos simbólicos

argZ =

pi/4

>> argW = sym(angle(w))

argW =

2

-pi/3

>> expZ=exp(z)

expZ =

1.4687 + 2.2874i

>> expW=exp(w)

expW =

-0.4364 - 2.6830i

>> expZW=exp(z^4\*w^2)

expZW =

8.2598e+02 + 2.8642e+03i

2.3

1

>> z=-i

z =

0.0000 - 1.0000i

>> mod=abs(z)

mod =

1

>> arg=sym(angle(z))

arg =

-pi/2

2

3

**MATRICES**

3.3

1

>> v=[1,2,i]

v =

1.0000 + 0.0000i 2.0000 + 0.0000i 0.0000 + 1.0000i

>> u=[1;2;i]

u =

1.0000 + 0.0000i

2.0000 + 0.0000i

0.0000 + 1.0000i

2

>> w=[3:2:25]

w =

3 5 7 9 11 13 15 17 19 21 23 25

3

>> h=w(9)

h =

19

4

>> w1=linspace(2,2,12)

w1 =

2 2 2 2 2 2 2 2 2 2 2 2

>> wt=w1.^w

wt =

Columns 1 through 8

8 32 128 512 2048 8192 32768 131072

Columns 9 through 12

524288 2097152 8388608 33554432

5

>> w2=linspace(2,3,54)

w2 =

Columns 1 through 10

2.0000 2.0189 2.0377 2.0566 2.0755 2.0943 2.1132 2.1321 2.1509 2.1698

Columns 11 through 20

2.1887 2.2075 2.2264 2.2453 2.2642 2.2830 2.3019 2.3208 2.3396 2.3585

Columns 21 through 30

2.3774 2.3962 2.4151 2.4340 2.4528 2.4717 2.4906 2.5094 2.5283 2.5472

Columns 31 through 40

2.5660 2.5849 2.6038 2.6226 2.6415 2.6604 2.6792 2.6981 2.7170 2.7358

Columns 41 through 50

2.7547 2.7736 2.7925 2.8113 2.8302 2.8491 2.8679 2.8868 2.9057 2.9245

Columns 51 through 54

2.9434 2.9623 2.9811 3.0000

3.4

1

>> A=[1,3,5;2,4,6;7,9,11;8,10,5]

A =

1 3 5

2 4 6

7 9 11

8 10 5

2

>> v=A(:,3)

v =

5

6

11

5

3

>> a13=A(1,3)

a13 =

5

4

>> A(2,:)=[]

A =

1 3 5

7 9 11

8 10 5

>> B=A

B =

1 3 5

7 9 11

8 10 5

5

>> w=[1;0;1]

w =

1

0

1

>> B(:,2)=w

C =

1 1 5

7 0 11

8 1 5

6

>> b=[7;2;7]

b =

7

2

7

>> D=[C,b]

D =

1 1 5 7

7 0 11 2

8 1 5 7

7

>> E=[A;b']

E =

1 3 5

2 4 6

7 9 11

8 10 5

7 2 7

3.5

1

>> A=ones(3,3)

A =

1 1 1

1 1 1

1 1 1

>> At=A+A

At =

2 2 2

2 2 2

2 2 2

>> I=eye(3,3)

I =

1 0 0

0 1 0

0 0 1

>> v=[0,0,3,3,3,3]

v =

0 0 3 3 3 3

>> M=[At,I;v;v]

M =

2 2 2 1 0 0

2 2 2 0 1 0

2 2 2 0 0 1

0 0 3 3 3 3

0 0 3 3 3 3

2

>> Mt=M'

Mt =

2 2 2 0 0

2 2 2 0 0

2 2 2 3 3

1 0 0 3 3

0 1 0 3 3

0 0 1 3 3

No es inversible por ser 5x6(no es cuadrada)

3.6

>> A=[1,3,5;2,4,6;7,9,11;8,10,15]

A =

1 3 5

2 4 6

7 9 11

8 10 15

>> B=[1,5;2,8;1,8]

B =

1 5

2 8

1 8

>> C=[1,2+i;3\*i,4;5,6;7,8]

C =

1.0000 + 0.0000i 2.0000 + 1.0000i

0.0000 + 3.0000i 4.0000 + 0.0000i

5.0000 + 0.0000i 6.0000 + 0.0000i

7.0000 + 0.0000i 8.0000 + 0.0000i

1

>> D=A\*B

D =

12 69

16 90

36 195

43 240

2

>> D1=[D,C]

D1 =

1.0e+02 \*

0.1200 + 0.0000i 0.6900 + 0.0000i 0.0100 + 0.0000i 0.0200 + 0.0100i

0.1600 + 0.0000i 0.9000 + 0.0000i 0.0000 + 0.0300i 0.0400 + 0.0000i

0.3600 + 0.0000i 1.9500 + 0.0000i 0.0500 + 0.0000i 0.0600 + 0.0000i

0.4300 + 0.0000i 2.4000 + 0.0000i 0.0700 + 0.0000i 0.0800 + 0.0000i

3

>> rangoD1=rank(D1)

rangoD1 =

4

>> detD1=det(D1)

detD1 =

1.4100e+02 + 1.0500e+03i

4

>> Ct=C.'

Ct =

1.0000 + 0.0000i 0.0000 + 3.0000i 5.0000 + 0.0000i 7.0000 + 0.0000i

2.0000 + 1.0000i 4.0000 + 0.0000i 6.0000 + 0.0000i 8.0000 + 0.0000i

>> Cconjt=C'

Cconjt =

1.0000 + 0.0000i 0.0000 - 3.0000i 5.0000 + 0.0000i 7.0000 + 0.0000i

2.0000 - 1.0000i 4.0000 + 0.0000i 6.0000 + 0.0000i 8.0000 + 0.0000i

>> D2=A.'\*inv(D1)

D2 =

-4.9581 - 7.7591i -1.9731 + 1.3884i -1.3198 - 2.4839i 3.2460 + 3.7283i

-6.5694 -10.4403i -2.7525 + 1.7599i -0.4161 - 3.3549i 3.2757 + 5.0675i

-10.0678 -15.3462i -3.6518 + 3.0239i -0.1704 - 4.8800i 4.4274 + 7.2431i

5º

>> filasD=size(D,1)

filasD =

4

>> columnsD=size(D,2)

columnsD =

2

6

>> E=D.\*C

E =

1.0e+03 \*

0.0120 + 0.0000i 0.1380 + 0.0690i

0.0000 + 0.0480i 0.3600 + 0.0000i

0.1800 + 0.0000i 1.1700 + 0.0000i

0.3010 + 0.0000i 1.9200 + 0.0000i

**DETERMINANTES**

4.1

>> A=[1.3,-2.3,3.2,4.3;-2,4.3,6,8;3,-6.7,9,-13;-4.2,8.9,-3.3,1.7]

A =

1.3000 -2.3000 3.2000 4.3000

-2.0000 4.3000 6.0000 8.0000

3.0000 -6.7000 9.0000 -13.0000

-4.2000 8.9000 -3.3000 1.7000

>> detA=det(A)

detA =

-216.5970

4.2

1

>> v=[1+x;1-x;1+z;1-z]

v =

x + 1

1 - x

z + 1

1 – z

>> M=diag(v)

M =

[ x + 1, 0, 0, 0]

[ 0, 1 - x, 0, 0]

[ 0, 0, z + 1, 0]

[ 0, 0, 0, 1 - z]

>> O=ones(4)

O =

1 1 1 1

1 1 1 1

1 1 1 1

1 1 1 1

>> I=eye(4)

I =

1 0 0 0

0 1 0 0

0 0 1 0

0 0 0 1

>> M=M-I+O

M =

[ x + 1, 1, 1, 1]

[ 1, 1 - x, 1, 1]

[ 1, 1, z + 1, 1]

[ 1, 1, 1, 1 - z]

2

>> E=subs(M,x,5)

E =

[ 6, 1, 1, 1]

[ 1, -4, 1, 1]

[ 1, 1, z + 1, 1]

[ 1, 1, 1, 1 - z]

>> N=subs(E,z,-17)

N =

[ 6, 1, 1, 1]

[ 1, -4, 1, 1]

[ 1, 1, -16, 1]

[ 1, 1, 1, 18]

3

>> s=solve(det(M))

s =

0

0

**SISTEMAS DE ECUACIONES**

5.1

>> syms a b c

>> ec1=a+b+c-2,ec2=a-b-c,ec3=a+b-c-4

ec1 =

a + b + c - 2

ec2 =

a - b - c

ec3 =

a + b - c - 4

>> [a1,b1,c1]=solve(ec1,ec2,ec3)

a1 =

1

b1 =

2

c1 =

-1

OTRA FORMA

>> A=[1,1,1;1,-1,-1;1,1,-1]

A =

1 1 1

1 -1 -1

1 1 -1

>> t=[2;0;4]

t =

2

0

4

>> Amp=[A,t]

Amp =

1 1 1 2

1 -1 -1 0

1 1 -1 4

>> [rank(A),rank(Amp)]

ans =

3 3

>> X=[a;b;c]

X =

a

b

c

>> Ec=A\*X-t

Ec =

a + b + c - 2

a - b - c

a + b - c - 4

>> [a1,b1,c1]=solve(Ec)

a1 =

1

b1 =

2

c1 =

-1

5.2

>> syms u v x y

>> ec1=u+v-2\*x,ec2=u-v-2\*y

ec1 =

u + v - 2\*x

ec2 =

u - v - 2\*y

>> [u1,v1]=solve(ec1,ec2,u,v)

u1 =

x + y

v1 =

x - y

>> [x1,y1]=solve(ec1,ec2)

x1 =

u/2 + v/2

y1 =

u/2 - v/2

5.3

1

>> syms x y z t

>> A=[1.1,2.21,7/5,0;-1.2,3.12,4.14,-1;0,-2.1,3,4;-1,1.6,2,0.5]

A =

1.1000 2.2100 1.4000 0

-1.2000 3.1200 4.1400 -1.0000

0 -2.1000 3.0000 4.0000

-1.0000 1.6000 2.0000 0.5000

>> b=[-3.32;-6.44;0.2;-4.7]

b =

-3.3200

-6.4400

0.2000

-4.7000

>> Amp=[A,b]

Amp =

1.1000 2.2100 1.4000 0 -3.3200

-1.2000 3.1200 4.1400 -1.0000 -6.4400

0 -2.1000 3.0000 4.0000 0.2000

-1.0000 1.6000 2.0000 0.5000 -4.7000

2

>> [rank(A),rank(Amp)]

ans =

4 4 Sistema compatible determinado

3

>> Gj=rref(Amp)

Gj =

1 0 0 0 1

0 1 0 0 -2

0 0 1 0 0

0 0 0 1 -1

Posibles soluciones:

X=1

Y=-2

Z=0

T=-1

4

>> X=[x;y;z;t]

X =

x

y

z

t

>> Ec=A\*X-b

Ec =

(11\*x)/10 + (221\*y)/100 + (7\*z)/5 + 83/25

(78\*y)/25 - (6\*x)/5 - t + (207\*z)/50 + 161/25

4\*t - (21\*y)/10 + 3\*z - 1/5

t/2 - x + (8\*y)/5 + 2\*z + 47/10

>> s=solve(Ec)

s =

struct with fields:

t: [1×1 sym]

x: [1×1 sym]

y: [1×1 sym]

z: [1×1 sym]

X=1

Y=-2

Z=0

T=-1

**ESPACIOS VECTORIALES**

1.1

a)

>> U=[1,-1,0,1;-1,0,1,0;1,-2,1,2]

U =

1 -1 0 1

-1 0 1 0

1 -2 1 2

>> rref(U)

ans =

1 0 -1 0

0 1 -1 -1

0 0 0 0

>> ans(3,:)=[]

ans =

1 0 -1 0

0 1 -1 -1

>> BaseU=ans

BaseU =

1 0 -1 0

0 1 -1 -1

>> rank(U)

ans =

2

>> null(sym(CoeEcV))

ans =

[ -2, -1]

[ 1, 1]

[ 1, 0]

[ 0, 1]

>> BaseV=ans.'

BaseV =

[ -2, 1, 1, 0]

[ -1, 1, 0, 1]

>> rank(BaseV)

ans =

2

>> Suma=[BaseU;BaseV]

Suma =

[ 1, 0, -1, 0]

[ 0, 1, -1, -1]

[ -2, 1, 1, 0]

[ -1, 1, 0, 1]

>> rref(Suma)

ans =

[ 1, 0, -1, 0]

[ 0, 1, -1, 0]

[ 0, 0, 0, 1]

[ 0, 0, 0, 0]

>> ans(4,:)=[]

ans =

[ 1, 0, -1, 0]

[ 0, 1, -1, 0]

[ 0, 0, 0, 1]

>> BaseSuma=ans

BaseSuma =

[ 1, 0, -1, 0]

[ 0, 1, -1, 0]

[ 0, 0, 0, 1]

>> rank(BaseSuma)

ans =

3 Dimensión de la suma

>> CoefEcUV=[CoefEcU;CoeEcV]

CoefEcUV =

[ 1, 1, 1, 0]

[ 0, 1, 0, 1]

[ 1, 1, 1, 0]

[ 1, 0, 2, 1]

>> BaseInter=null(CoefEcUV)

BaseInter =

3

-1

-2

1

>> BaseInter.'

ans =

[ 3, -1, -2, 1]

B)

>> u=[5,-4,-1,4]

u =

5 -4 -1 4

>> A=[1,-1;-1,0;0,1;1,0]

A =

1 -1

-1 0

0 1

1. 0

>> Amp=[A,u.']

Amp =

1 -1 5

-1 0 -4

0 1 -1

1 0 4

>> rref(Amp)

ans =

1 0 4

0 1 -1

0 0 0

0 0 0

Se obtiene a=4 y b=-1

C)

>> EcParamSuma=solve(EcU)

EcParamSuma =

struct with fields:

x: [1×1 sym]

y: [1×1 sym]

>> [x1,y1]=solve(EcU)

x1 =

t - z

y1 =

-t

**APLICACIONES LINEALES**

2.1

a)

>> M=[1,-1,2,5;-1,0,3,2;4,-8,34,52;2,-3,12,19;0,-1,5,7]

M =

1 -1 2 5

-1 0 3 2

4 -8 34 52

2 -3 12 19

0 -1 5 7

>> b1=[2,-1,-4,2]

b1 =

2 -1 -4 2

>> b2=[1,-1,-2,2]

b2 =

1 -1 -2 2

>> b3=[-1,-1,3,4]

b3 =

-1 -1 3 4

>> b4=[-2,0,4,1]

b4 =

-2 0 4 1

>> B=[b1;b2;b3;b4].'

B =

2 1 -1 -2

-1 -1 -1 0

-4 -2 3 4

2 2 4 1

>> c1=[1,1,1,1,1]

c1 =

1 1 1 1 1

>> c2=[0,1,1,1,1]

c2 =

0 1 1 1 1

>> c3=[0,0,1,1,1]

c3 =

0 0 1 1 1

>> c4=[0,0,0,1,1]

c4 =

0 0 0 1 1

>> c5=[0,0,0,0,1]

c5 =

0 0 0 0 1

>> C=[c1;c2;c3;c4;c5].'

C =

1 0 0 0 0

1 1 0 0 0

1 1 1 0 0

1 1 1 1 0

1 1 1 1 1

>> P=B

P =

2 1 -1 -2

-1 -1 -1 0

-4 -2 3 4

2 2 4 1

>> Q=C

Q =

1 0 0 0 0

1 1 0 0 0

1 1 1 0 0

1 1 1 1 0

1 1 1 1 1

>> M1=inv(Q)\*M\*P

M1 =

5 8 26 11

-15 -11 -8 5

-6 51 296 164

13 -29 -201 -117

-2 -14 -69 -36

b)

>> u=[1,-1,0,1]

u =

1 -1 0 1

>> v=[1,0,-1,0,1]

v =

1 0 -1 0 1

>> syms u1 u2 u3 u4

>> X=[u1;u2;u3;u4]

X =

u1

u2

u3

u4

>> Ecvectu=X-(inv(P)\*u.')

Ecvectu =

u1 + 6

u2 - 5

u3 - 2

u4 + 5

Sol:(-6,5,2,-5)

>> solve(Ecvectu)

ans =

struct with fields:

u1: [1×1 sym]

u2: [1×1 sym]

u3: [1×1 sym]

u4: [1×1 sym]

>> Ecvectu.'

ans =

[ u1 + 6, u2 - 5, u3 - 2, u4 + 5]

>> syms v1 v2 v3 v4 v5

>> Y=[v1;v2;v3;v4;v5]

Y =

v1

v2

v3

v4

v5

>> Ecvectv=Y-(Q\*v.')

Ecvectv =

v1 - 1

v2 - 1

v3

v4

v5 – 1

Sol: (1,1,0,0,1)

>> Ecvectv.'

ans =

[ v1 - 1, v2 - 1, v3, v4, v5 - 1]

c)

>> Ker=null(sym(M))

Ker =

0

11/3

-2/3

1

>> BaseKer=Ker.'

BaseKer =

[ 0, 11/3, -2/3, 1]

>> rank(BaseKer)

ans =

1

>> Img=colspace(sym(M))

Img =

[ 1, 0, 0]

[ 0, 1, 0]

[ 0, 0, 1]

[ -1, -1, 1/2]

[ 1, 1, 0]

>> BaseImg=Img.'

BaseImg =

[ 1, 0, 0, -1, 1]

[ 0, 1, 0, -1, 1]

[ 0, 0, 1, 1/2, 0]

>> rank(BaseImg)

ans =

3

d)

>> k1=[1,-1,2,3]

k1 =

1 -1 2 3

>> k2=[0,11,-2,3]

k2 =

0 11 -2 3

>> fk1k2=M\*[k1;k2].'

fk1k2 =

21 0

11 0

236 0

86 0

32 0

K1 no pertenece

K2 si pertenece

2.2

a)

>> v1=[1,3,1,0],v2=[-2,2,-2,0],v3=[8,2,8,0],v4=[-2,0,-2,0]

v1 =

1 3 1 0

v2 =

-2 2 -2 0

v3 =

8 2 8 0

v4 =

-2 0 -2 0

>> B1=[v1;v2;v3;v4]

B1 =

1 3 1 0

-2 2 -2 0

8 2 8 0

-2 0 -2 0

>> w1=[1,0,1,0],w2=[0,-1,1,0],w3=[1,1,0,1],w4=[0,0,-1,1]

w1 =

1 0 1 0

w2 =

0 -1 1 0

w3 =

1 1 0 1

w4 =

0 0 -1 1

>> B2=[w1;w2;w3;w4]

B2 =

1 0 1 0

0 -1 1 0

1 1 0 1

0 0 -1 1

>> P=B2.'

P =

1 0 1 0

0 -1 1 0

1 1 0 -1

0 0 1 1

>> M=[B1].'

M =

1 -2 8 -2

3 2 2 0

1 -2 8 -2

0 0 0 0

>> M1=M\*inv(P)

M1 =

-6 9 7 5

2 -1 1 1

-6 9 7 5

0 0 0 0

b)

c)

d)