clc

clear

syms u1 u2 v1 v2 ;

vars=[u1;u2;v1;v2];

u=[u1;u2];

v=[v1;v2];

u\_h=u;

T=eye(2);

I=eye(2);

prog=sosprogram(vars);

A1=[-1+u1+s1^2+u1\*u2-u2^2, 1; -1, -1];

A2=[-1+u1+u1^2+u1\*u2-u2^2, 1; 0.2172, -1];

B1=[u1;0];

B2=[u1;0];

[prog,U]=sospolymatriuvar(prog,monomials(u,[0:0]),[2,2],'symmetric');

U

[prog,M1]=sospolymatriuvar(prog,monomials(u,[0:1]),[1,2]);

[prog,M2]=sospolymatriuvar(prog,monomials(u,[0:1]),[1,2]);

M1

[prog,eps1]=sossosvar(prog,monomials(u,[0:0]));

[prog,eps211]=sossosvar(prog,monomials(u,[0:0]));

[prog,eps212]=sossosvar(prog,monomials(u,[0:0]));

[prog,eps222]=sossosvar(prog,monomials(u,[0:0]));

SOS1=v.'\*(U-eps1.\*I)\*v;

prog=sosineq(prog,SOS1,'Mineq');

SOS2=-v.'\*(T\*A1\*U-T\*B1\*M1+U\*A1.'\*T.'-M1.'\*B1.'\*T.'+...

T\*A1\*U-T\*B1\*M1+U\*A1.'\*T.'-M1.'\*B1.'\*T.'-...

diff(U,u2).\*(A1(2,:)\*u\_h)-...

diff(U,u2).\*(A1(2,:)\*u\_h)+...

eps211.\*I)\*v;

prog=sosineq(prog,SOS2,'Mineq');

SOS3=-v.'\*(T\*A1\*U-T\*B1\*M2+U\*A1.'\*T.'-M2.'\*B1.'\*T.'+...

T\*A2\*U-T\*B2\*M1+U\*A2.'\*T.'-M1.'\*B2.'\*T.'-...

diff(U,u2).\*(A1(2,:)\*u\_h)-...

diff(U,u2).\*(A1(2,:)\*u\_h)+...

eps212.\*I)\*v;

prog=sosineq(prog,SOS3,'Mineq');

SOS4=-v.'\*(T\*A2\*U-T\*B2\*M2+U\*A2.'\*T.'-M2.'\*B2.'\*T.'+...

T\*A2\*U-T\*B2\*M2+U\*A2.'\*T.'-M2.'\*B2.'\*T.'-...

diff(U,u2).\*(A2(2,:)\*u\_h)-...

diff(U,u2).\*(A2(2,:)\*u\_h)+...

eps212.\*I)\*v;

prog=sosineq(prog,SOS4,'Mineq');

SOS5=eps1;

prog=sosineq(prog,SOS5,'Mineq');

SOS6=eps211;

prog=sosineq(prog,SOS6,'Mineq');

SOS7=eps212;

prog=sosineq(prog,SOS7,'Mineq');

SOS8=eps222;

prog=sosineq(prog,SOS8,'Mineq');

[prog,info]=sossolve(prog);

U=sosgetsol(prog,U)

M1=sosgetsol(prog,M1)

M2=sosgetsol(prog,M2)

eps1=sosgetsol(prog,eps1)

eps211=sosgetsol(prog,eps211)

eps212=sosgetsol(prog,eps212)

eps222=sosgetsol(prog,eps222)

F1=sosgetsol(prog,M1,15)\*inv(sosgetsol(prog,U,15))

F2=sosgetsol(prog,M2,15)\*inv(sosgetsol(prog,U,15))

U

P=inv(U)

V=u\_h.'\*P\*u\_h

eig\_P = eig(P)

u=-(F1\*u\_h+F2\*u\_h)