T.C.

$$A(\delta) = \begin{bmatrix} -4 & 4 \\ -5 & 0 \end{bmatrix} + \delta \begin{bmatrix} -2 & 2 \\ -1 & 4 \end{bmatrix} \qquad \delta \in [-\mu \ \mu]$$

1 parametro incerto

$$A(\delta) \in \mathcal{A} = \left\{ A(\alpha) : A(\alpha) = \alpha_1 A(-\mu) + \alpha_2 A(\mu) \right\}$$
$$\alpha_1 + \alpha_2 = 1 \quad \alpha_i \geq 0 \quad i = 1,2$$

	$\max \mu$
stabilità quadratica	0.7526
stabilità robusta	1.6666

N.B. Il sistema è robustamente stabile $\delta \in [-\mu \ \mu]$ con $\mu = 1.6666$ nel dominio di incertezza

Nel medesimo dominio il sistema non è quadraticamente stabile ovvero $\nexists \ P = P^T > 0 : \ A_i^T P + P A_i < 0 \quad i = 1, \dots, N$

T.D.

$$A(\delta) = \begin{bmatrix} 0.8 & -0.25 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0.2 & 0.03 \\ 0 & 0 & 1 & 0 \end{bmatrix} + \delta \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \begin{bmatrix} 0.8 & -0.5 & 0 & 1 \end{bmatrix} \qquad \delta \in [-\gamma \ \gamma]$$

	$\max \gamma$
Stabilità quadratica	0.4279
stabilita' robusta	0.4619

```
%STABILITA' QUADRATICA


%ESEMPIO 1 TEMPO CONTINUO
%A=[-4,4;-5,0]+delta*[-2,2;-1,4];
%|delta|<=mu;
mu=0.7526;
%A(\alpha) appartiene al politopo con vertici
A1=[-4,4;-5,0]-mu*[-2,2;-1,4];
A2=[-4,4;-5,0]+mu*[-2,2;-1,4];

n=2;

quiz=sdmpb('stabilità quadratica T.C.');

[quiz,Pindex]=sdmvar(quiz,n,'s','P');

[quiz,lmi0index]=sdmlmi(quiz,n,'P>0');
quiz=sdmineq(quiz,lmi0index,Pindex,-0.5,eye(n));

[quiz,lmi1index]=sdmlmi(quiz,n,'Lyapunov vartice 1');
quiz=sdmineq(quiz,[lmi1index 1 1],Pindex,eye(n),A1);

[quiz,lmi2index]=sdmlmi(quiz,n,'Lyapunov vartice 2');
quiz=sdmineq(quiz,[lmi2index 1 1],Pindex,eye(n),A2);

quiz=sdmsol(quiz)
P=quiz(Pindex)
eig(P)
```

Condizioni LMI da imporre

$P > 0 \quad \Leftrightarrow -P < 0$

$A_1^T P + P A_1 < 0$

$A_2^T P + P A_2 < 0$

Sedumi

$-0.5P < 0$

$PA_1 < 0$

$PA_2 < 0$

```
%ESEMPIO 2 TEMPO DISCRETO
%A(delta)=[0.8,-0.25,0,1;1,0,0,0;0,0,0.2,0.03;0,0,1,0]+delta*[0,0,1,0]'*[0.8,-
0.5,0,1]
%|delta|<=gamma

gamma=0.4279;

A1=[0.8,-0.25,0,1;1,0,0,0;0,0,0.2,0.03;0,0,1,0]-gamma*[0,0,1,0]'*[0.8,-0.5,0,1];
A2=[0.8,-0.25,0,1;1,0,0,0;0,0,0.2,0.03;0,0,1,0]+gamma*[0,0,1,0]'*[0.8,-0.5,0,1];

n=4;
quiz=sdmpb('stabilità quadratica T.D.');

[quiz,Pindex]=sdmvar(quiz,n,'s','P');

[quiz,lmi1index]=sdmlmi(quiz,n,'P>0');
quiz=sdmineq(quiz,lmi1index,Pindex,-0.5,eye(n));

[quiz,lmi2index]=sdmlmi(quiz,n,'A1tPA1-P<0');
quiz=sdmineq(quiz,lmi2index,Pindex,0.5*A1',A1);
quiz=sdmineq(quiz,lmi2index,Pindex,-0.5,eye(n));

[quiz,lmi3index]=sdmlmi(quiz,n,'A2tPA2-P<0');
quiz=sdmineq(quiz,lmi3index,Pindex,0.5*A2',A2);
quiz=sdmineq(quiz,lmi3index,Pindex,-0.5,eye(n));

quiz=sdmsol(quiz);
P=quiz(Pindex)
eig(P)
```

LMIs da imporre

$P > 0 \quad \Leftrightarrow \quad -P < 0$

$A_1^T P A_1 - P < 0$

$A_2^T P A_2 - P < 0$

Sedumi

$-0.5P < 0$

$+0.5A_1^T P A_1 - 0.5P < 0$

$0.5A_2^T P A_2 - 0.5P < 0$