IDENTIFICAREA SISTEMELOR

PROIECT – Partea II

Identificarea unei axe actionate cu motor BLDC

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1. **Identificarea unei axe actionate cu motor BLDC**

**1.1 Obtinerea datelor experimentale**

* + 1. **Introducere**

In Figura 1.1 este prezentat un CNC actionat cu motore BLDC:



Figura 1.1: CNC actionata cu motor BLDC

Sistemul mecanic de pozitionare si sistemul de actionare cu motor BLDC pentru o axa este prezentat in Figura 1.2.:

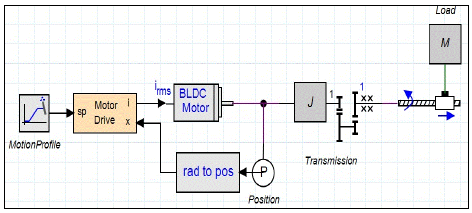


Figura 1.2: Modelul de actionare si pozitionare al unei axe

Motorul este comandat cu ajutorul unui driver de putere comandat in PWM. Viteza unghiulara si pozitia se masoara pe baza semnalelor provenite de la cei trei senzori Hall montati in statorul motorului.

Aparatura utilizata: sursa de alimentare, multimetru, driver de putere, osciloscop, sistem de achizitie.

* 1. **Achizitia datelor de intrare-iesire**

Utilizând un sistem numeric de comanda se genereaza semnalele de comanda pentru motorul BLDC (SPAP+SP)¸ si se achizitioneaza datele intrare-iesire în vederea procesarii ulterioare (comanda (factor de umplere), curent(i), vitezaunghiulara¸ si pozitia unghiulara.

* + 1. **Desfasurarea experimentului**

1. Se alimenteaza ansamblul driver + motor BLDC cu = 24 V .

2. Se efectueaza urmatorul experiment:

A.1 Se genereaza un semnal de tip SPAB având caracteristicile corelate cu dinamica ansablului „motor BLDC + axa“;

A.2 Se vizualizeaza ¸si se masoara sincron intrarea, si iesirile, obtinând datele experimentale: ,,,] k=1, 2, .....

* 1. **Procesarea datelor experimentale**

Vizualizarea datelor experimentale utilizând mediul Matlab.

În functie de datele experimentale obtinute (,,] k=1, 2, ..... ) se pot efectua urmatoarele operatii: filtrare antidistorsiune de tip medie alunecatoare, eliminarea componentelor continue stationare sau cvasistationare, scalarea intrarilor si iesirilor.

Se vor determina functiile de transfer ale ansablului „motor BLDC + axa“ utilizând metodele de identificare parametrica (MCMMPR, MCMMPE, VI, MEP, etc.).

**1.3.1 Validarea modelului**

Validarea modelului determinat se face pe baza erorii de predictie reziduale¸ si pe baza decorelarii dintre observatii¸ si eroarea de predictie.

De asemenea se va compara raspunsul experimental cu raspunsul modelului la intrarea cu care a fost obtinut raspunsul experimental. Se calculeaza eroarea medie patratica:

J=

1. **Vizualizarea datelor experimentale**

Scopul lucrarii este de a determina functia de transfer al ansamblului “motor BLDC + axa” utilizand metodele de identificare parametrica.

Vizualizarea datelor experimentale se face utilizând Matlab.

Incepem prin a importa in Matlab fisierul cu care se lucreaza misaros\_marius.mat. Din acest fisier ne intereseaza vectorul linie Y care contine 3 elemente: intrarea(semnal pseudo aleator binar – SPAB, notata in cod u), viteza unghiulara(notata in cod w) si pozitia unghiulara a axei pe care se deplaseaza motorul(notata in cod y).

c=misaros\_marius;

t=double (c.X.Data');

u=double (c.Y(1,3).Data');%intrare

w=double (c.Y(1,2).Data');%viteza

y=double (c.Y(1,1).Data');%pozitie

x = length(t);

Te=t(2)-t(1); %perioada de esantionare

subplot(311) ; plot(t,u)

subplot(312) ; plot(t,w,’g’)

subplot(313) ; plot(t,y,‘r’)

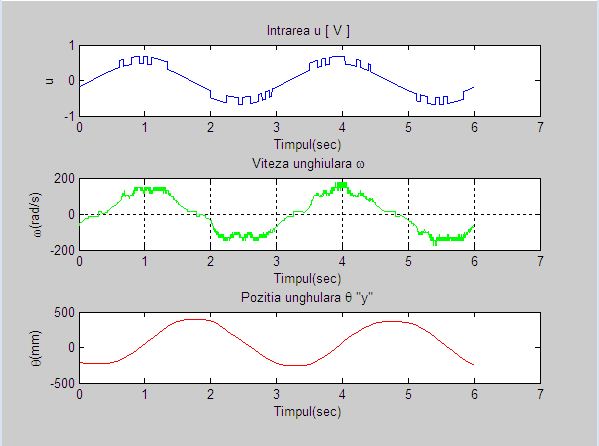
Primul pas este afisarea acestor date:

Fig. 1: Semnalul initial (u-intrarea, w-viteza, y-pozitia)

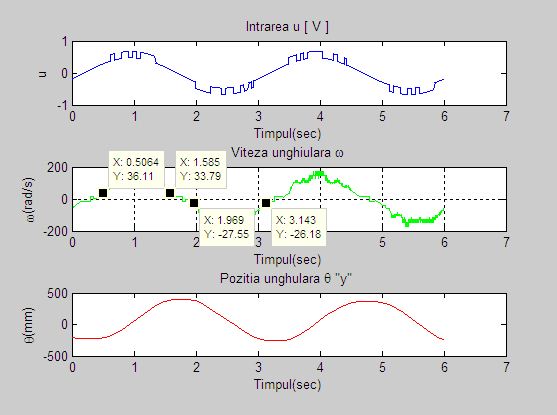
Pe semnalul w-viteza am ales cele 4 puncte cu care am impartit graficul in doua parti pentru a elimina trecerile prin zero. Pe prima parte am facut identificarea, iar pe cea de-a doua am facut validarea.

Fig. 3: Alegerea punctelor

Am selectat cele 4 puncte de pe figura si le-am exportat cu dateinit.DataIndex.

%Datele sunt alese de pe sensuri diferite ale motorului

i1=852;%date pt identificare

i2=2592;

i3=3354;%date pt validare

i4=5150;

Pentru identificare avem:

t1=t(i1:i2); %timpul

u1=u(i1:i2); %intrarea

w1=w(i1:i2); %viteza

y1=y(i1:i2); %pozitia

Pentru validare avem:

t2=t(i3:i4); %timpul

u2=u(i3:i4); %intrarea

w2=w(i3:i4); %viteza

y2=y(i3:i4); %pozitia

Cu functia iddata am creat doua obiecte pentru identificare si validare la viteza:

d\_id\_viteza=iddata(w1,u1,Te);

d\_vd\_viteza=iddata(w2,u2,Te);

Cu functia iddata am creat doua obiecte pentru identificare si validare la pozitie:

d\_id\_pozitie=iddata(y1,w1,Te);

d\_vd\_pozitie=iddata(y2,w2,Te);

**AUTOCORELATIA**

Identificare pentru viteza unghiulara:

1)Modelul sistemului de la u -> w

**Metoda Celor mai mici pătrate extinsă (ARMAX)**

* model: A()\*y(t)=\*B()\*u(t)+e(t)\*C(), unde e(t) este perturbaţia;
* în acest caz se modelează atât funcţia de transfer a sistemului cât şi funcţia de transfer a perturbaţiei.

**Cod folosit in Matlab:**

Marmax = armax(d\_id\_viteza,[1 1 1 1])

figure

compare(d\_vd\_viteza,Marmax)

figure

resid(Marmax,d\_vd\_viteza)

![Fig.5 Gradul de urmarire al ARMAX este de 68.44%
](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDgRXhpZgAATU0AKgAAAAgABAE7AAIAAAAHAAAISodpAAQAAAABAAAIUpydAAEAAAAOAAAQyuocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAENhcm1lbgAAAAWQAwACAAAAFAAAEKCQBAACAAAAFAAAELSSkQACAAAAAzE0AACSkgACAAAAAzE0AADqHAAHAAAIDAAACJQAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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                                                  Fig. 4  ARMAX de la intrarea u la viteaza w






](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDgRXhpZgAATU0AKgAAAAgABAE7AAIAAAAHAAAISodpAAQAAAABAAAIUpydAAEAAAAOAAAQyuocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAENhcm1lbgAAAAWQAwACAAAAFAAAEKCQBAACAAAAFAAAELSSkQACAAAAAzM1AACSkgACAAAAAzM1AADqHAAHAAAIDAAACJQAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAyMDE4OjAxOjExIDIwOjIyOjA3ADIwMTg6MDE6MTEgMjA6MjI6MDcAAABDAGEAcgBtAGUAbgAAAP/hCxlodHRwOi8vbnMuYWRvYmUuY29tL3hhcC8xLjAvADw/eHBhY2tldCBiZWdpbj0n77u/JyBpZD0nVzVNME1wQ2VoaUh6cmVTek5UY3prYzlkJz8+DQo8eDp4bXBtZXRhIHhtbG5zOng9ImFkb2JlOm5zOm1ldGEvIj48cmRmOlJERiB4bWxuczpyZGY9Imh0dHA6Ly93d3cudzMub3JnLzE5OTkvMDIvMjItcmRmLXN5bnRheC1ucyMiPjxyZGY6RGVzY3JpcHRpb24gcmRmOmFib3V0PSJ1dWlkOmZhZjViZGQ1LWJhM2QtMTFkYS1hZDMxLWQzM2Q3NTE4MmYxYiIgeG1sbnM6ZGM9Imh0dHA6Ly9wdXJsLm9yZy9kYy9lbGVtZW50cy8xLjEvIi8+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczp4bXA9Imh0dHA6Ly9ucy5hZG9iZS5jb20veGFwLzEuMC8iPjx4bXA6Q3JlYXRlRGF0ZT4yMDE4LTAxLTExVDIwOjIyOjA3LjM0ODwveG1wOkNyZWF0ZURhdGU+PC9yZGY6RGVzY3JpcHRpb24+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczpkYz0iaHR0cDovL3B1cmwub3JnL2RjL2VsZW1lbnRzLzEuMS8iPjxkYzpjcmVhdG9yPjxyZGY6U2VxIHhtbG5zOnJkZj0iaHR0cDovL3d3dy53My5vcmcvMTk5OS8wMi8yMi1yZGYtc3ludGF4LW5zIyI+PHJkZjpsaT5DYXJtZW48L3JkZjpsaT48L3JkZjpTZXE+DQoJCQk8L2RjOmNyZWF0b3I+PC9yZGY6RGVzY3JpcHRpb24+PC9yZGY6UkRGPjwveDp4bXBtZXRhPg0KICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICA8P3hwYWNrZXQgZW5kPSd3Jz8+/9sAQwAHBQUGBQQHBgUGCAcHCAoRCwoJCQoVDxAMERgVGhkYFRgXGx4nIRsdJR0XGCIuIiUoKSssKxogLzMvKjInKisq/9sAQwEHCAgKCQoUCwsUKhwYHCoqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioq/8AAEQgBnwIvAwEiAAIRAQMRAf/EAB8AAAEFAQEBAQEBAAAAAAAAAAABAgMEBQYHCAkKC//EALUQAAIBAwMCBAMFBQQEAAABfQECAwAEEQUSITFBBhNRYQcicRQygZGhCCNCscEVUtHwJDNicoIJChYXGBkaJSYnKCkqNDU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ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cum se observa in figura de mai sus modelul este validat prin trecerea testului de autocorelatie si intercorelatie deoarece se incadreaza in banda de incredere reprezentata cu galben.

Fig. 4 ARMAX de la intrarea u la viteaza w

Gradul de urmarire obtinut folosind aceasta metoda este de 40.77%

In continuare am calculate functia de transfer din discret dupa care am transformat-o in continuu.

den1=Marmax.B

num1=Marmax.A

H\_wu\_armax=tf(den1,num1,Te)

H1=d2c(H\_wu\_armax,'zoh')

Modelul este caracterizat prin 3 polinoame: A(z)y(t) = B(z)u(t) + C(z)e(t)

A(z) = 1 - 0.9772 z^-1

B(z) = 5.234

C(z) = 1 + 0.008268 z^-1

Functia de transfer obtinuta in discret este:

H1(z) =

Dupa ce functia de transfer de la u-w este trecuta in domeniul continuu ea este urmatoarea:

H1=

2)Modelul sistemului de la w -> y

Se va identifica modelul sistemului cu intrarea 'w' si iesirea 'y' folosind tot metoda ARMAX.

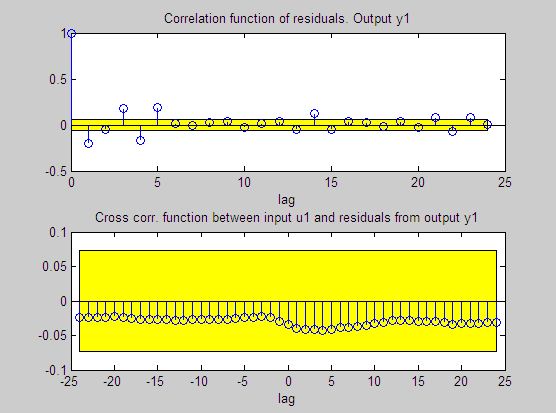
Marmax2=armax(d\_id\_pozitie,[1 1 1 1])

figure

compare(d\_vd\_pozitie,Marmax2)

figure

resid(Marmax2,d\_vd\_pozitie)

 Fig. 5 Autocorelatia de la viteza w la pozitia y

![A group of people on a boat

Description generated with low confidence](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDgRXhpZgAATU0AKgAAAAgABAE7AAIAAAAHAAAISodpAAQAAAABAAAIUpydAAEAAAAOAAAQyuocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAENhcm1lbgAAAAWQAwACAAAAFAAAEKCQBAACAAAAFAAAELSSkQACAAAAAzg0AACSkgACAAAAAzg0AADqHAAHAAAIDAAACJQAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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LJauzS3WksoAmdjlnhckCNzySpyjt12FnkOlpmq2mr2zT2LyEI5jkjmheGSNsA7XjcBlOCpAIGQykcEGrlZep6M93crfadeyadqKIE8+NFdZkBJWOVD99AxJ4KuMsFddzZ6VONVWqaPv/n39d/XSytbY1KKwdL8SF7uDSvEFuul6zKG8u3aQNHdhPvPA/8AGvU7Th1GCygEE71Yzpypu0l/X6gncKKKKgYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAGF4y/5Fp/8Ar6tf/SiOsKt3xl/yLT/9fVr/AOlEdYVABRRRQAUUUUAFFFFABVHWkjl0C/jnnW3ia2kDzMCRGCpyxAIPHXgj61eqjrThNBv2NxDbf6PJ++nkCJH8p5ZiCAB6kH6GlLZlQ+JHLaLJq2o69az/ANqRsbWBo2WXwzeWgeMshbDySBd3yjHBxydprt64jwTJNNqcrR2UxtFiKG8GuXl5CWyhAVJ1UMCDkSJuGBjPPPb1ctkQhkcMcIYRRom9izbVAyT1J96fRRUjCiiigAq94U/5GHVf+vW1/wDQ56xf7Sj/ALQ+y+XL97Z5uBs37d23rnOOemPfNbXhT/kYdV/69bX/ANDnoA6yiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigCvfWNtqVlJaXsfmQyYJAYqVIIKsrDBVgQCGBBBAIIIBrBkutX8MSKs9vNq2iAqqTw+ZNe2wOcB4wpMyg7RvB34I3K2GkPTUVtCryrlkrx7fquz/ppiaIbS7tr+0jurG4iubeVd0c0Lh0ceoI4IqasO40B7K5lv8Aw08djcyOZp7QKq2185OSZcKSrnJ/eJ82dpYSBAlP0bxLBql3Jp13bS6Zq8MYll066ZDIEOP3ilWKumTjcpIB4ODkU5Uk1z03dfivVfrt6PQL9zZooorAYUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAYXjL/kWn/6+rX/ANKI6wq3fGX/ACLT/wDX1a/+lEdYVABRRRQAUUUUAFFFFABVa+0+21GDybyPeAdyMrFHjbBG5GUhlbBIyCDzVmigDM03Sp9MuZduoS3NrKxcx3KBpEb5QAsgxlQB/EGYk5LeunRRQAUUUUAFFFFAGb9huP7SLZi+zGf7QTk792zbtxjGM85z7Y71raFpsGoeIdR+0SXSeXa22Ps93LDnLzddjDPTv0qOr3hT/kYdV/69bX/0OegDrKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAqjq2kwaxY/Z53lhdG3wXNu+yW3kwQHRuxwSO4IJUgqSDeoqoycXdbgc7ba5Po93aaV4rmh8+5YR2upRx+VBducYj2lj5cvXCZIYDKnO5E6Ko7i3hu7aW2uoY54JkMckUihldSMFSDwQRxiudN1f+E2mfVJmvfD8Y3JeOzPcWS46SjGZIxj/W5LjI3ggNJW/Kq3wK0u3f08/L7uwtjpqKbHIksayROro4DKynIYHoQadXMMKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooA5TxdpNtFpL3iyXhlN5bNta9maPJuI8/uy+3HPAxgdsYqhW74y/5Fp/+vq1/wDSiOsKgAooooAKKKKACiiigAooooAKKKKACiiigAooooAKveFP+Rh1X/r1tf8A0OeqNXvCn/Iw6r/162v/AKHPQB1lFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAHNxaZL4S3y6QJ7jRy5aTTEUMbNT1a3AG4qDkmLng/u8FRG+5Y31rqdhDe6fcR3FtOgeKWM5V1PcVYrnLzRr3Rrm61Xwt87Tv5tzpDsqw3LZy7xk/6uZvXOxjncAWMg6eZVvidpd+/r5+b+b6i2OjoqjpOr2utWP2mz81NrbJYbiJopYXwDtdGAZTgg4I5BBGQQTerCUZRfLJWYwoooqQCiiigAooooAKKKKACiiigAooooAKKKKACiiigDC8Zf8AItP/ANfVr/6UR1hVu+Mv+Raf/r6tf/SiOsKgAooooAKKKKACiiigAooooAKKKKACiiigAopk0qQRNJKcKvXAyfoAOp9qpSazClpBcLDPIs0XnbVUZRAASxye2RwMn0BoA0KveFP+Rh1X/r1tf/Q56xf7TiN8LYRykFtnm4Gzft3beuc456Y981teFP8AkYdV/wCvW1/9DnoA6yiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAxtb0a5uZU1PQ7hbTVoFAVnJ8q6QZPkzAdV+ZsNgshYkZyytPpesJfSSWd1GtpqduAbizL7io7OhwN8bfwvgdwQrKyrpVn6polnq3lSTp5d3bZNrexACe1Y4yY2IOM4GQcqw+Vgykg7xnGS5KnyfVf5r8V07NW7GhRXP22tTaPPbaZ4suYBc3DrFaX8cZihvHP8GCT5cuf4Cx3jBUn5kToKipTlB67PZ9H6f1ps9QTuFFFFZjCiiigAooooAKKKKACiiigAooooAKKKKAMLxl/wAi0/8A19Wv/pRHWFW74y/5Fp/+vq1/9KI6wqACiiigAooooAKKKKACiiigAooooAKKKKAIUgkSeSRrmWRW6RME2p9MKD+ZNZjaXeJY2sUDQmRLU20hdiAAQPmHHOMdOM56itmigLmWmnTpfAKYvsolE2cnfkJt24xjHGc59sd62NC02DUPEOo/aJLpPLtbbH2e7lhzl5uuxhnp36VHV7wp/wAjDqv/AF62v/oc9AHWUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBHcW8N3bS211DHPBMhjkikUMrqRgqQeCCOMVz7/2v4amjMf2vXNHORIGw93ZAdCDwZ4woxj5ps85kLYXpKK1p1XFcrV12/rb+r6CaKum6nY6xp0N/pV3Dd2k4zHNC4ZWwcHkehBBHYgirVY99osiXsmq6JJ5GotgyRPKwt7sAAbZEGQGICgShS67U+8oKM7S9fgvb59LuwtnrEEfmT2LPk7M48yM4HmRk9HA74YK2VFSpJrnp6r8V/wADz/LYL9zWooorAYUUUUAFFFFABRRRQAUUUUAFFFFAHKeLtJtotJe8WS8MpvLZtrXszR5NxHn92X2454GMDtjFUK3fGX/ItP8A9fVr/wClEdYVABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVe8Kf8jDqv/Xra/8Aoc9UaveFP+Rh1X/r1tf/AEOegDrKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACqOraRa61Y/ZrzzU2tvimt5WilhfBG5HUhlOCRkHkEg5BIN6iqjKUXzRdmBzL+ILjw1OLfxYyrp4AEOt5xGxzgLcAKFhblRuzsYg/wCrJVK6aiudbSb/AMPsknhgLNYA5n0qaRjhQDgWzs2IuMARn938qgeV8zHf93V/uy/B/wCX5eiQtUdFRWfpeu6drPmrp9zumgx59vKjRTwbs7fMicB0yASNwGRyMjmtCsJwlCXLJWY73CiiipAKKKKACiiigAooooAwvGX/ACLT/wDX1a/+lEdYVbvjL/kWn/6+rX/0ojrCoAKKKKACiiigAooooAKKKKACiiigAooooAKKiuHmjhJtoRNJkAKz7R9ScHj8DWc+szLFlbNXlQSNKom+UKhAbacfMeeBgd84xQBrVe8Kf8jDqv8A162v/oc9YK6mzXwiWAG3Mgi87fzvK7vu46Y4znr271veFP8AkYdV/wCvW1/9DnoA6yiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAM/VNFttV8qSSSe2urfPkXdrKY5YicZ5HDLlVJRwyMVXcpwKz/7a1DROPFUcDWv8OqWMUnlA9T50R3GBQP4y7JhGLNHlVPQUVvCr7vJNXj+K9H0/LyFbsR29xDd20VzazRzwTIJI5Y2DK6kZDAjggjnNSVz7eGjpc8t54Wl+wyu5llsC3+iXLejLg+UTz88WPmO51kxtNix8QxyXsem6vB/ZWpyZ8q2mlVhdBQSzQMD+8UYJxhXAwWRNy5bo8y5qbuvxXy/Vad7bBfubFFFFc4wooooAKKKKAMLxl/yLT/8AX1a/+lEdYVbvjL/kWn/6+rX/ANKI6wqACiiigAooooAKKKKACiiigAooooAKKKKAKN3pzyJKbO6kgllI3M7u6gZ5AXcAuemRg+lQSaVcSW8aC5hiZY2hYxW5C+W2OACxwRjg5I9q1aKAM9dMZb4SrOBbiQS+Ts53hdv3s9Mc4x179q1NC0rTtT8Q6j/aVha3nl2tts+0QrJty82cZHGcD8qjq94U/wCRh1X/AK9bX/0OegDrKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACq99p9nqllJZ6naQXlrJjfBcRCRHwQRlSCDggH6irFFNNxd1uBzL6dr/h+PzNEu5tdtwWLWGpzqJETkgQz7cs3bExbd8vzpglruleKtN1S+OnsZbDVFUs2nXyeVPgEgso6SLkH50LLx1rZqjq2i6br1j9k1eziu4Q25RIvMbYIDo3VGAJwykEZ4Iro9rCp/FWvdb/NbP8H5is1sXqK5ufR9e0mFv+EX1NLqP+Gx1p5JVX/cuBmUdWJ3+bnAVdgpn/CbRadL5PivTbrQ2X713IplsuW2qftKjaoY9PMCN0yBkZPq8pa0nzem/wB2/wB115hfudPRUNpd21/aR3VjcRXNvKu6OaFw6OPUEcEVNXO007MZyni7RdKh0l76HTLOO7N5bMbhbdRIS1xHk7sZycnP1qhW74y/5Fp/+vq1/wDSiOsKkAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFXvCn/Iw6r/162v8A6HPVGr3hT/kYdV/69bX/ANDnoA6yiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigDn7zwTodzcy3lpbyaVfTb2e80uVrWR3Y5LvsIEpB5xIGGc8cnMf2Pxdpkn+halY65bl+ItST7LOAV6maFShw3QeSOD97I56SiulYmpa0/eXnr+O6+TQrI4HxD4i1OSxGna14avdPeW8t1iuYnW5t32zoWJdOUXgbfMCls9MggSVu+Mv+Raf/AK+rX/0ojrCrGcoyd4q39eev4v8AQEFFFFQMKKKKACiiigAooooAKKKKACiiigAoqK5kkigZ4Y1kcdAz7B9SewH0NZx1qQ2scsNqsrFHkcCX5diHBKnHzZzxwMjuKANar3hT/kYdV/69bX/0OesFdTZr4RLADbmQRedv53ld33cdMcZz17d63vCn/Iw6r/162v8A6HPQB1lFFFABRRRQAUVRsL2S6vdThkVQtpdLDGVHJBhjfn3y5/DFXqACiiigAooqjYXsl1e6nDIqhbS6WGMqOSDDG/Pvlz+GKAL1FFFABRRRQAUVR0m9kv7KSaZVVluriEBRxiOZ0H44UZ96vUAFFFFABRRVHSb2S/spJplVWW6uIQFHGI5nQfjhRn3oAvUUUUAFFFFABRVHRL2TUtA0++nVVlubWOZwgwoLKCcZ7c1eoAKKKKACiiqOiXsmpaBp99OqrLc2sczhBhQWUE4z25oAvUUUUAFFFFABRVHRL2TUtA0++nVVlubWOZwgwoLKCcZ7c1eoAKKKKACiqOt3smm6BqF9AqtLbWskyBxlSVUkZx24q9QAUUUUAFFFUdbvZNN0DUL6BVaW2tZJkDjKkqpIzjtxQBeooooAKKKKACiqOt3smm6BqF9AqtLbWskyBxlSVUkZx24q9QAUUUUAYXjL/kWn/wCvq1/9KI6wq3fGX/ItP/19Wv8A6UR1hUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAVZLNg0ktrPJFM+OZHaRBz/cLYA+mKqSaPM8eUu1SWQOsziLhg+M7Rn5TwMHJ79a1aKAM9dMZb4SrOBbiQS+Ts53hdv3s9Mc4x179qnudNsbyQSXdlbzuBtDSxKxA9Mke9WaKAKH9h6T/0C7L/AMB0/wAKP7D0n/oF2X/gOn+FX6KAKH9h6T/0C7L/AMB0/wAKr3dloFjt+06fZrvzjFqGwB1JwvAHcngVr1marBcvIHtoPP3wSQEbgNpbGGOT045xk9ODQCEudM0KztnuLnT7COKMZZ2t0wP0qUaHpBGRpdl/4Dp/hS31s9xpFzbLEWkELJEWx8zFMZHPHUjnHftV1eFAPpTDoij/AGHpP/QLsv8AwHT/AAo/sPSf+gXZf+A6f4VfopAZF3ZaBY7ftOn2a784xahsAdScLwB3J4FLc6fodoqtNplr85wqx2Ydm4zwFUmn6rBcvIHtoPP3wSQEbgNpbGGOT045xk9ODT7yW9htkisrWWRshGkUpkLj7wDMAT25784I6nQBsOkaLPCksOm2TI4ypFuvI/Kn/wBh6T/0C7L/AMB0/wAKs2aLHZxIsTwgLjY5BYfUgkE/iamoAof2HpP/AEC7L/wHT/Cq81loFvcpBLp9msj4wPsoIGTgZIXAyeBnGT0rXrKvra5e+cRQl47gRAybgBHsck5BOeh4wDz1xQA26sdBsyouNOtF3An5bQNgDqThTge54qx/Yek/9Auy/wDAdP8ACk1ETXFsYRZTSrJuU7JVUqQeCRuGVPXHPHBFXowwiQSEFwo3EdCaAKX9h6T/ANAuy/8AAdP8KP7D0n/oF2X/AIDp/hV+igDImstAt7lIJdPs1kfGB9lBAycDJC4GTwM4yelSXGl6JawmW406xRAQCTbr1JwO3rTb62uXvnEUJeO4EQMm4AR7HJOQTnoeMA89cUmsWN5qEKtbMieXuxFLHu3HOAwIYY4zjPr2NAE/9h6T/wBAuy/8B0/wo/sPSf8AoF2X/gOn+FXlztG4gnHJAwDS0AUP7D0n/oF2X/gOn+FV/sWgfbfsn9n2fnen2UYzjON23Gcc4znHNa9ZRtrn+1CvkHyTci48/cMY8vbtxnOc+2Md+1ADZbDQobpLd9LtjK4BASy3gAnAJIUgD64qx/Yek/8AQLsv/AdP8KgureWW9SeG0uI5nRMTLcYVMEnDqGwcZPQN1rWoDqUP7D0n/oF2X/gOn+FH9h6T/wBAuy/8B0/wq/RQBkfYtA+2/ZP7Ps/O9PsoxnGcbtuM45xnOOaSez0C2nWGbTrQO2OlmCFycDcQuFyfXFPNtc/2oV8g+SbkXHn7hjHl7duM5zn2xjv2qOe0un1AzxRXCtNsKFZgqwkdQ6hvm/8AHh9OpAZa/sPSf+gXZf8AgOn+FH9h6T/0C7L/AMB0/wAKv0UAUP7D0n/oF2X/AIDp/hVf7FoH237J/Z9n53p9lGM4zjdtxnHOM5xzWvWUba5/tQr5B8k3IuPP3DGPL27cZznPtjHftQBHc2ugWkqxz6XACxADLp5Zck4A3BcdferX9h6T/wBAuy/8B0/wp7xy3F7au8bJDGrSMrEZD8BQcHsC3tVygCh/Yek/9Auy/wDAdP8ACj+w9J/6Bdl/4Dp/hV+igDIistAnunt4tPszImcj7KADg4OCVwcHg4zjvSGz0AXgtTp1p5pO3/jzG3OM43bcZxzjOaW1t7qG7G+2bZb+cyuHX99vbcAOfTrnHOOvWkNrc/2uZBA/MwcTb18vZtAIKZzv6jdjPvjihAyz/Yek/wDQLsv/AAHT/Cj+w9J/6Bdl/wCA6f4VfooAof2HpP8A0C7L/wAB0/wqvFZaBPdPbxafZmRM5H2UAHBwcErg4PBxnHetesi1t7qG7G+2bZb+cyuHX99vbcAOfTrnHOOvWgAFloBvDajTrTzQcH/RBtzjON23Gcc4zmrH9h6T/wBAuy/8B0/wqtJZXD6upRJ0t/OEzHzEMZIXqB9/dnHH3e/WtijoHUof2HpP/QLsv/AdP8KP7D0n/oF2X/gOn+FX6KAMu50zQ7O2e4utPsY4oxlma3TA/SpRoekEZGl2X/gOn+FSapbm60u5ijjDyNE4jBx94qQME9OtWl4UA+lAFH+w9J/6Bdl/4Dp/hR/Yek/9Auy/8B0/wq/RQBSj0bTIpFki020R0IZWWBQVI6EHFXaKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiub1nwzoN/4isbi/0TTrmaZn8ySa0R2fCcZJGTjAoA6SiuKS71Np5FtNRNpDDcIgiit4treZdSxsTlf7oBGMcjJzkg0pvEGtxa3YWX9p28aK+xTdTLG9+RO6MAiwN5hCqpIjaPBbJ4Iw7A9EehUVl3zs2uWULDMIgmnAKEgyKUC9PQMxx36jpXFWXivWDomr/wDExiu7m3MO65E8LQ2wdsOd6RZj2jkrLESu0klxnCB6HpNFcKmu3J0TT31XxPBpsEomP9qwPFIkzKwCL5kkSxnILH5UG7b8pwDm1Drd1J4lWA6qTNvVf7M+zqm6AwhjcbWHmL85xkttGNuN3NHS/wDX9f8AD7B2/r+v66nYUVxSanqdtpTS3utSbJ7W1uJLp4Ih9iEjESMuFxtAAwX3beSxIBFY93r91pujwXOna3E1u95ct5weGNrv958uzzF8uTjJKq8ZYcqccUPSVv66f5jasrnptFZttJnW5BGrKs1sk0ikYw2SASPUgY/4CK0qBBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBHLBHM0bSLkxNvQgkEHp29iakoooAKKKKACiiigCNIY45ZJVX55SC5JJzgYH0Ht9fU1JRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAH//Z)Dupa cum se observa, acest model trece testul de autocorelatie.

Gradul de urmarire obtinut folosind aceasta metoda este de 99.47%

In continuare am calculat functia de transfer din discret dupa care am transformat-o in continuu.

den2=Marmax2.B

num2=Marmax2.A

H\_yw\_armax=tf(den2,num2,Te)

H2=d2c(H\_yw\_armax,'zoh')

Modelul este definut de 3 polinoame : A(z)y(t) = B(z)u(t) + C(z)e(t)

A(z) = 1 - z^-1

B(z) = 0.003087

C(z) = 1 - 0.8455 z^-1

Functia de transfer obtinuta in discret este :

H2(z) =

Functiade transfer trecuta din discret in continuu (d2c) este :

H2=

Deoarce este vorba despre un integrator, se va neglija termenul liber al numitorului. Asadar functia de transfer a sistemului cu intrarea w si iesirea y este:

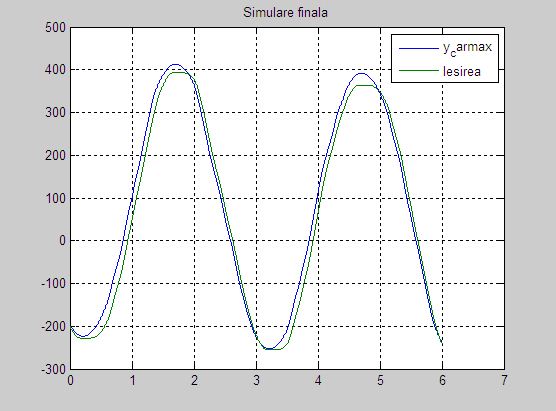
H2=

In final, dupa validarea celor doua functii de transfer a sistemului, se vor inseria pentru a obtine functia de transfer de la intrarea u(PWM) la iesirea y a sistemului.

Aceasta este:

H\_armax=H1 \* H2 =

Am simulat acest sistem la intrarea u pentru a vedea cat de bine se suprapune cu iesirea din datele achizitionate.

 Fig.6 Simularea sistemului obtinut cu intrarea u

**INTERCORELATIA**

**Metoda erorii la iesire (OE / Output Error)**

y(t) = [B(q)/F(q)]u(t) + e(t)

Se va folosi aceasta metoda pentru a identifica si valida functia de transfer a sistemului cu intrarea u(PWM) si iesirea w(viteza unghiulara) si a sistemului cu intrarea w si iesirea y(pozitia).

1. **Modelul sistemului de la u-> w**

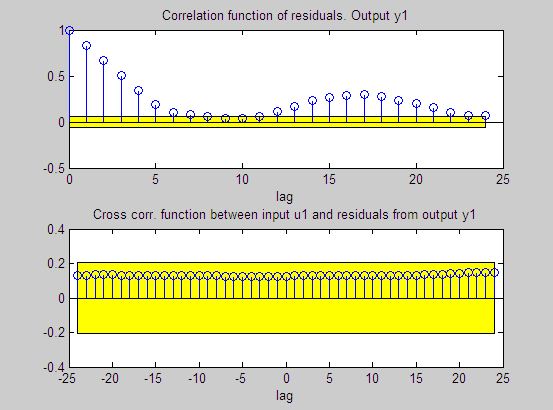
Se va identifica sistemul cu intrarea ‘u‘ si iesirea ‘w’ folosindu-ma de metoda OE.

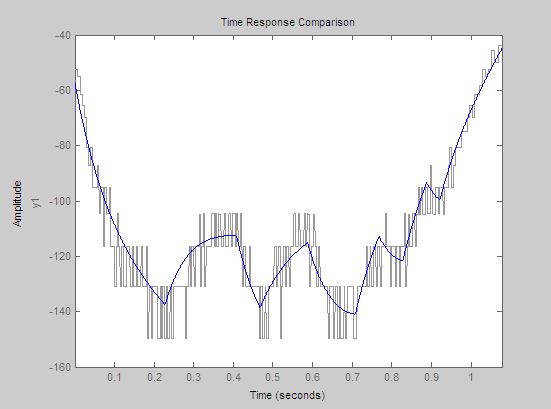
Moe=oe(d\_id\_viteza,[1 1 1])

figure

compare(d\_vd\_viteza,Moe)

figure

resid(Moe,d\_vd\_viteza)

Dupa cum se observa, acest model este validat prin trecerea testului de intercorelatie deoarece se incadreaza in banda de incredere reprezentata in grafic prin banda galbena.

Gradul de urmarire obtinut folosind aceasta metoda este de 68.49%

In continuare am calculat functia de transfer din discret dupa care am transformat-o in continuu.

den3=Moe.B

num3=Moe.F

H\_wu\_oe=tf(den3,num3,Te)

H3=d2c(H\_wu\_oe,'zoh')

Modelul este definut de 2 polinoame: y(t) = [B(z)/F(z)]u(t) + e(t)

B(z) = 1.895

F(z) = 1 - 0.992 z^-1

Functia de transfer obtinuta in discret este:

H3(z)=

Dupa ce functia de transfer de la u-w este trecuta in domeniul

continuu ea este urmatoarea:

H3=

1. **Modelul sistemului de la w -> y**

Se va identifica modelul sistemului cu intrarea 'u' si iesirea 'w' folosind functia OE.

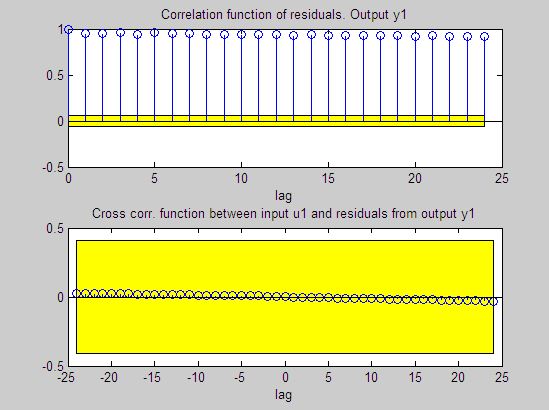
Moe2=oe(d\_id\_pozitie,[1 1 1])

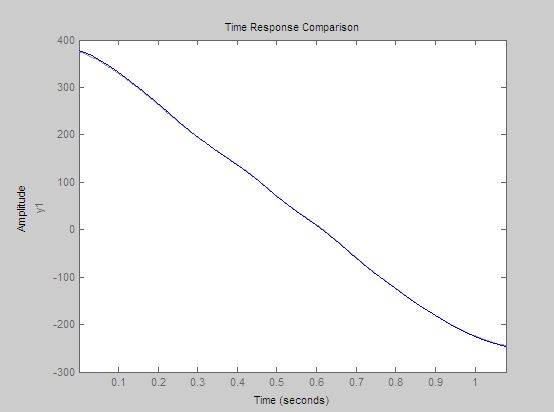
figure

compare(d\_vd\_pozitie,Moe2)

figure

resid(Moe2,d\_vd\_pozitie)

 Fig. 8 Intercorelatia folosind metoda OE

Se poate observa ca modelul este valid datorita trecerii testului de intercorelatie.

Gradul de urmarire obtinut folosind aceasta metoda este de 99.24%

Functia de transfer de la viteza la pozitie cu metoda OE

den4=Moe2.B

num4=Moe2.F

H\_yw\_oe=tf(den4,num4,Te)

H4=d2c(H\_yw\_oe,'zoh')

Modelul este definit de cele doua polinoame B(q) si F(q):y(t) = [B(z)/F(z)]u(t)+e(t)

B(z) = 0.003093

F(z) = 1 - z^-1

Functia de transfer in domeniul discret este:

H4(z)=

Functia de transfer trecuta in domeniul continuu este:

H4 =

Deoarce este vorba despre un integrator, se va neglija termenul liber al numitorului.

Asadar functia de transfer a sistemului cu intrarea w si iesirea y este:

H4=

In final, dupa validarea celor doua functii de transfer a sistemului, se vor inseria pentru a obtine functia de transfer de la intrarea u(PWM) la iesirea y a sistemului.

Aceasta este:

H\_oe=H3 \* H4 =

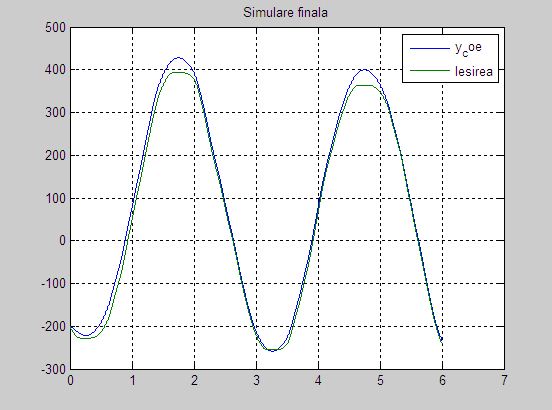
Am simulat acest sistem la intrarea u pentru a vedea cat de bine se suprapune cu iesirea din datele achizitionate.

Fig. 9 Suprapunerea intrarii cu iesirea in urma datelor achizitionate

**3) Calcularea vitezei si pozitiei utilizand spatiul starilor**

In functiile de transfer vor fi folosite valorile Km, Tm si Ti pentru a obtine matricile necesare reprezentarii sitemului nostru SIMO in **spatiul starilor**.

Matricile calculate pentru spatial starilor sunt:

A = [-1/Tm 0 ; 1/Ti 0];

B = [km/Tm; 0];

C = [1 0; 0 1];

D = [0 ; 0];

Am folosit functiile de transfer obtinute prin metoda Output Error. Avand in vedere ca functia de transfer dintre intrarea u si viteza w este de forma:

=;

=3171;

Cea de la viteza w la pozitia y este:

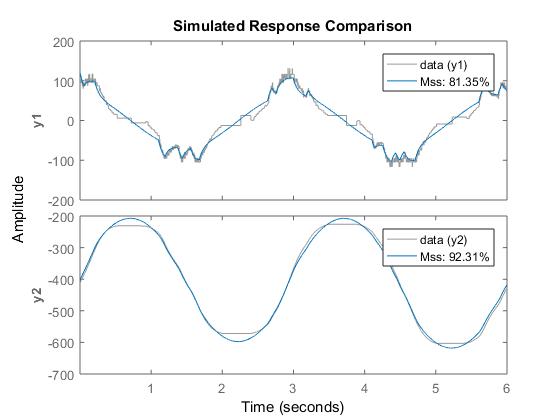
=

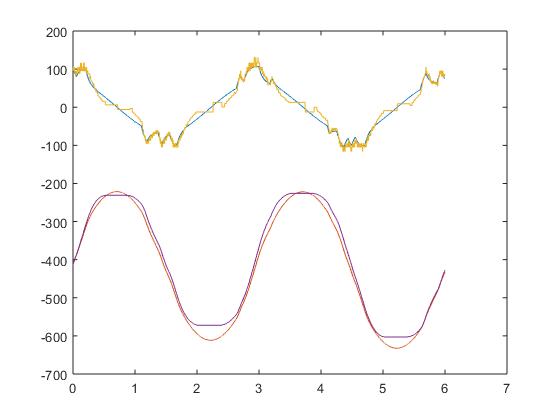
Ti=

Am folosit metoda **lsim** a calcula viteza si pozitia obtinute cu ajutorul spatiului starilor:

sys = ss( A , B , C , D );

calculat=lsim(sys,u,t,[w(1) y(1)]);

 Am afisat vectorii vitezei si pozitiei calculate in aceeasi figura cu datele primate:

Fig. 10 Suprapunearea datelor de la intreare cu cele obtinute dupa aplicarea spatiului starilor( cu conditii initiale nenule)

Ultima etapa este calcularea erorii medie patratice:

Unde e valoarea masurata, e valoarea calculata si N e numarul de esantioane.

Pentru ca sistemul sa fie de tip SIMO (Single Input Multiple Output), functia de transfer va fi de forma: