Technion – Israel Institute of Technology

Faculty of Mechanical Engineering



HW1

Kinematics, Dynamics, and Control of Robots

036026

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# Question 1

## a.

Here below we wrote the function my dist a as prescribe….

**function** R**=**MyDist\_a**(**P**,**P0**)**

R**=**sqrt**(**sum**((**P**-**P0**).^**2**,**2**));**

**end**

## b.

The function myDist\_b waste time and resources by calling MyDist\_a iteratively on each set of two points…

**function** R**=**MyDist\_b**(**P**,**P0**)**

R**=**zeros**(**size**(**P**,**1**),**1**);**

**for** ii**=**1**:**length**(**R**)**

R**(**ii**)=**MyDist\_a**(**P(ii)**,**P0**);**

**end**

**end**

## c.

In this question we compared the two different methods by computing the time it takes for the functions to run on the same sets of points.  
We ran the test for different number of points in the range of

P0**=[**0.5**,**0.5**];**

logk**=**1**:**0.2**:**5**;**

k**=**10.**^**logk**;** %amount of points in Pk

**[**a**,**b**]=**deal**(**zeros**(**size**(**k**)));**

**for** ii**=**1**:**length**(**k**)**

P**=**rand**(**round**(**k**(**ii**)),**2**);**

tic**;**

R**=**MyDist\_a**(**P**,**P0**);**

a**(**ii**)=**toc**;**

tic**;**

R**=**MyDist\_b**(**P**,**P0**);**

b**(**ii**)=**toc**;**

**end**



## d.

With some magic tricks, we were able to render the figure below, displaying random points and their distances to some origin point

The text is displayed in a location by the following formula:



# Q2.

## a.

The analytic Taylor polynomials are…., calculated based on recursive formula for general 2d derivatives of the taylor series..

**function** poly **=** Taylor\_fun**(**n**,**f**,**point\_x**,** point\_y**)**

syms x y

poly **=** subs**(**subs**(**f**,**x**,**point\_x**),**y**,**point\_y**);**

**for** i **=** 1**:**n

poly **=** poly **+** Taylor\_part\_fun**(**1**,**i**,**f**,**point\_x**,** point\_y**);**

**end**

**end**

**function** **[**poly**]** **=** Taylor\_part\_fun**(**j**,**n**,**f**,**point\_x**,**point\_y**)**

syms x y

**if** j **>** n

poly **=** subs**(**subs**(**f**,**x**,**point\_x**),**y**,**point\_y**);**

**else**

poly **=** Taylor\_part\_fun**(**j**+**1**,**n**,**diff**(**f**,**x**),**point\_x**,**point\_y**)/**j**\*(**x**-**point\_x**)+**Taylor\_part\_fun**(**j**+**1**,**n**,**diff**(**f**,**y**),**point\_x**,**point\_y**)/**j**\*(**y**-**point\_y**);**

**end**

**end**

## b.

present below the output graph, we did not compute RMS…..

Chart, surface chart

Description automatically generated

# Q3

We heavily edited the code provided to us, which aimed to solve the two equations using Newton’s method:

e**=**1e-2**;** %FIX: changed from 1e5

xkm1**=[**1**;** 1**];**

xk**=**xkm1**+**2**\***e**;** %just to make sure we enter the first loop iteration

iterN**=**0**;** %fixed naming convention. Start with lower letters

fnF**=@(**x**)** **[**x**(**1**)^**2**+**x**(**2**)^**2**-**4 **;**

exp**(**x**(**1**))+**x**(**2**)-**1**];** %fix from old code: turned + const to -

fnJ**=@(**x**)** **[**2**\***x**(**1**)** 2**\***x**(**2**);**

exp**(**x**(**1**))** 1**];**

**while** norm**(**xk**-**xkm1**,**2**)>**e %Euclid norm

xkm1**=**xk**;**

F**=**fnF**(**xkm1**);**

J**=**fnJ**(**xkm1**);**

dx**=-**J**\**F**;** %FIX: changed from right divide to left divide. we need to solve J\*dx=-F

xk**=**xkm1**+**dx**;**

iterN**=**iterN**+**1**;**

**end**

Printing our solution to the given initial condition provided the following:

with interations = 6

xk=-1.81626,0.837368

F(xk)=0.00494268,0.000334923

We also ploted the solution to confirm



# Q4

The following pseudocode describe the flow-chart…

INPUT X

IF X<10 THEN

IF X<5 THEN

X = 5

ELSE

PRINT X

END

ELSE

DO

IF X<50 EXIT

ELSE

X = X-5

ENDDO

ENDIF