MHEMPC demo version 2

HOW TO INSTALL, RUN AND CHECK CAPABILITIES

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Get Started with MHEMPC

MHEMPC is all about MPC, which works on a dynamic plant. The plant has things happening inside it, that can change its outputs by changing inputs that go into it. For this demonstration we use a set of differential equations that describe a 7 output and 5 manipulable inputs dynamic system named 'Heavy Oil Fractionator'. By using Ordinary Differential Equation (ODE) tools, these equations can simulate this dynamic plant. As time proceeds, inputs can be sent to this simulation and outputs can be generated. This is a simulated plant.

MHEMPC is another piece of software that interacts with this plant. It is the actual MPC, but glued to this simulation only. Although it has all the code necessary for the commercial MHEMPC, this is only for the purpose of demonstration only.

Installation

Extract the download and create C:\X, C:\Xd and C:\XdS. Run C:\Windows\System32\cmd.exe as Administrator. See Figure below:
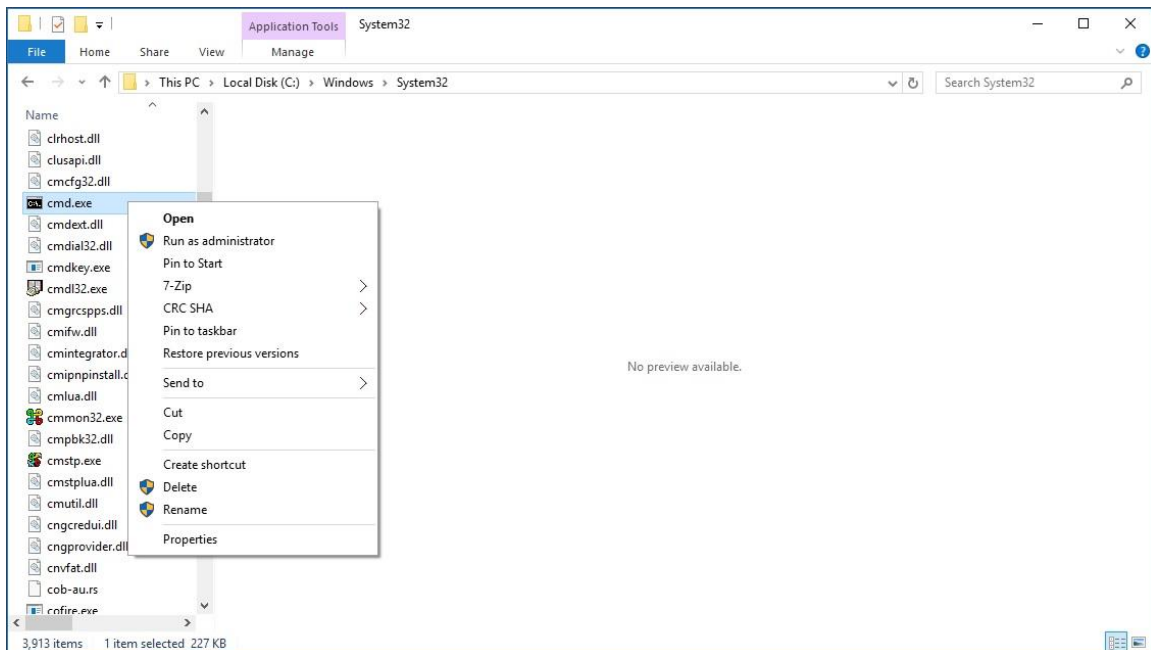
Click on 'Run as administrator' and get the following done as in figure below.

Now the plant is running as a service program, named aSvcName. It can be viewed in the Task Manager.

To start Task Manager, right click windows 'start' button. Go to Services tab and see aSvcName in 'Running' condition. Right now all real-time data are 0.0. MHEMPC connects to this and changes the MVs and thereby the CVs. Anytime, to resume everything to 0.0, close MHEMPC, right-click 'aSvcName', stop, and then start.

Administrator: C:\Windows\System32\cmd.exe — □ ×

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Microsoft Windows [Version 10.0.10240]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Windows\system32>cd\

C:\>cd x

C:\X>install.bat

C:\X>svc install
Service installed successfully

C:\X>start.bat

C:\X>svccontrol start aSvcName

Service start pending...
Service started successfully.

C:\X>
```
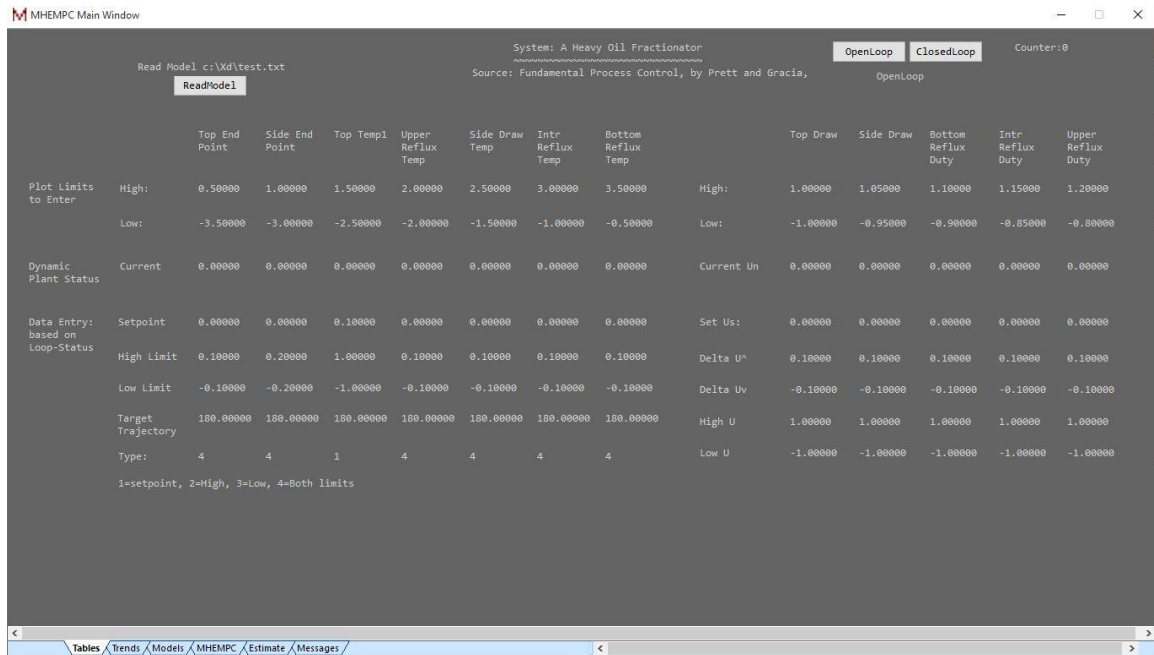
Task Manager — □ ×

File   Options   View

Processes | Performance | App history | Startup | Users | Details | **Services**

Name	PID	Description	Status	Group
AJRouter		AllJoyn Router Service	Stopped	LocalService
ALG		Application Layer Gateway Service	Stopped	
AMD External Events Utility	1520	AMD External Events Utility	Running	
AppIDSvc		Application Identity	Stopped	LocalServiceN...
Appinfo	1000	Application Information	Running	netsvcs
AppMgmt		Application Management	Stopped	netsvcs
AppReadiness		App Readiness	Stopped	AppReadiness
AppXSvc	4768	AppX Deployment Service (AppX...	Running	wsappx
aspnet_state		ASP.NET State Service	Stopped	
aSvcName	1252	aSvcName	Running	
AudioEndpointBuilder	388	Windows Audio Endpoint Builder	Running	LocalSystemN...
Audiosrv	1236	Windows Audio	Running	LocalServiceN...
AxInstSV		ActiveX Installer (AxInstSV)	Stopped	AxInstSVGroup
BDESVC		BitLocker Drive Encryption Service	Stopped	netsvcs
BFE	1672	Base Filtering Engine	Running	LocalServiceN...
BITS	1000	Background Intelligent Transfer ...	Running	netsvcs
BrokerInfrastructure	804	Background Tasks Infrastructure ...	Running	DcomLaunch
Browser		Computer Browser	Stopped	netsvcs
BthHFSrv		Bluetooth Handsfree Service	Stopped	LocalServiceA...
bthserv		Bluetooth Support Service	Stopped	LocalService
CDPSvc		CDPSvc	Stopped	LocalService
CertPropSvc	1000	Certificate Propagation	Running	netsvcs
ClipSVC		Client License Service (ClipSVC)	Stopped	wsappx

⌃ Fewer details | ⚙ Open Services

MHEMPC

A2.exe is MHEMPC. So start it.

MHEMPC Main Window — — □ ×

Read Model c:\Xd\test.txt

[ReadModel]

System: A Heavy Oil Fractionator
Source: Fundamental Process Control, by Prett and Gracia,

[OpenLoop] [ClosedLoop]   Counter:0

OpenLoop

		Top End Point	Side End Point	Top Temp1	Upper Reflux Temp	Side Draw Temp	Intr Reflux Temp	Bottom Reflux Temp		Top Draw	Side Draw	Bottom Reflux Duty	Intr Reflux Duty	Upper Reflux Duty
Plot Limits to Enter	High:	0.50000	1.00000	1.50000	2.00000	2.50000	3.00000	3.50000	High:	1.00000	1.05000	1.10000	1.15000	1.20000
	Low:	-3.50000	-3.00000	-2.50000	-2.00000	-1.50000	-1.00000	-0.50000	Low:	-1.00000	-0.95000	-0.90000	-0.85000	-0.80000
Dynamic Plant Status	Current	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	Current Un	0.00000	0.00000	0.00000	0.00000	0.00000
Data Entry: based on Loop-Status	Setpoint	0.00000	0.00000	0.10000	0.00000	0.00000	0.00000	0.00000	Set Us:	0.00000	0.00000	0.00000	0.00000	0.00000
	High Limit	0.10000	0.20000	1.00000	0.10000	0.10000	0.10000	0.10000	Delta U^	0.10000	0.10000	0.10000	0.10000	0.10000
	Low Limit	-0.10000	-0.20000	-1.00000	-0.10000	-0.10000	-0.10000	-0.10000	Delta Uv	-0.10000	-0.10000	-0.10000	-0.10000	-0.10000
	Target Trajectory	180.00000	180.00000	180.00000	180.00000	180.00000	180.00000	180.00000	High U	1.00000	1.00000	1.00000	1.00000	1.00000
	Type:	4	4	1	4	4	4	4	Low U	-1.00000	-1.00000	-1.00000	-1.00000	-1.00000

1=setpoint, 2=High, 3=Low, 4=Both limits

Tables / Trends / Models / MHEMPC / Estimate / Messages

Out of 6 tabs, 'Tables' and 'MHEMPC' accept user input data. As soon as a new entry is done, the whole tuning configuration is saved in 'C:\Xd\P7X5.txt'. The format is not text though, but binary. If this file is deleted, no problem. A2.exe has all these hard coded too, to its default values. As tuning proceeds, the work is immediately saved so that if power to the computer goes away, tuning is saved. Closing and reopening A2.exe will read the values from this saved file, if any present.

Changing any parameter is by clicking on its text on the screen. An input window will pop-up and values can be changed

Starting the Simulation

The download is equipped with a sample C:\Xd\P7X5.txt. To start simulation on this sample file, click 'ReadModel' button. It reads the plant model pre-identified by identification software, which is not included as of now. The file name is 'C:\Xd\test.txt'. A later demo version will include identification software attached to this simulated plant, also using MSSQL database files for model development management.

Go to tab 'Trend'. In due course of time, the closed loop response of the plant will be similar to the cover picture. If the trend limits need be changed, click on the description text of the tag, a pop-up window shall proceed.

Other tabs

Browse them too. The 'Estimate' tab has 2 CV values often same, seldom different. The left one is measured CV, right one is MHE estimates. Right now, no noise and plant-model mismatch is introduced, hence MHE is not very meaningful, though it is a part of the process, as always.

A3.exe

Run A3.exe. It starts with this. It looks for file 'NUM7X5.txt'. It can be found in c:\Xd with A2.exe running. At the end of a simulation run of A2.exe, this directory content can be saved in another.
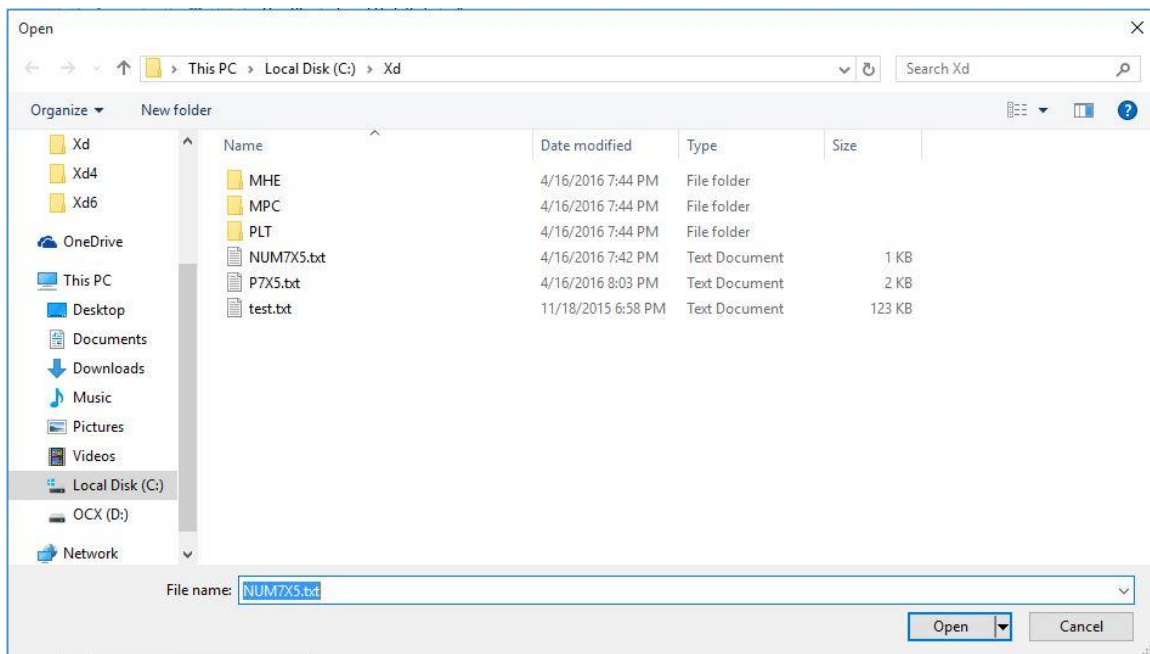
A3.exe reads the total points in this run from NUM7X5.txt, proceeds to read contents of subdirectories 'MHE', 'MPC' and 'PLT'. They contain every point values from 1 till current. A3.exe reads them as present, displays them as plots with plot hi and lo values determined from the total run. It also displays current tuning values from P7X5.txt.

A3.exe can read currently running simulation if C:\Xd\NUM7X5.txt is chosen. But it does not update itself.

Check A3.exe on C:\XdS and check functionalities.

This is an on-going project, so many more demo updates will keep coming.