An Update on MATLAB at SHARCNET

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April 15, 2015

Types of MATLAB packages

- MATLAB Site license (Western, McMaster, UWaterloo)
- MATLAB Compile Runtime (mcr)
- MATLAB PCT (Parallel Computing Toolbox)

Site license

- UW, Western, McMaster: license is managed on a campus license server, e.g., by IST at UW.

- username match: your SHARCNET username should be the same as your institution username

- Versions on the site specific SHARCNET systems

  UW: orca, hound, mosaic (R2012b, R2014a)
  Western: goblin (R2012a, R2014a)
  McMaster: wobbie, iqaluk (R2012b, R2014a)

- License number is limited

  UW: 300 basic MATLAB license campus wide,
  limit to 50 on SHARCNET systems
  fewer licenses for many toolboxes

Site license

- Run batch job

 - basic command should include the following flags:

 matlab -nodisplay -nosplash -nojvm -singleCompThread

 - run job in the serial (default) queue using sqsub

 sqsub --mpp=2g -r 1.0d -o test.log -i test.m ./uwmatlab

where ‘uwmatlab’ is a simple runscript script for UW users:

/opt/sharcnet/local/matlab/R2014a/bin/matlab -nodisplay -nosplash -nojvm -singleCompThread

- Use ‘mcc’ to compile to standard binary code

 mcc -m -R ' -nosplash -nodisplay -nodesktop -nojvm -singleCompThread' myprog.m

- Run compiled code job

 sqsub --mpp=4g -r 1.0h -o run_myprog.log ./run_myprog.sh path/R2014a

Options for non-site license users

- Versions available on several clusters

  - R2012b.mcr
  - R2013b.mcr
  - R2014a.mcr

- MATLAB Compiler Runtime (mcr)
  - your license has MATLAB compiler, mcc, same version
  - compile your MATLAB codes on a Linux system
  - run the binary code on SHARCNET without license check

- Run mcr job (pre-load match version, e.g., R2014a)

```
module load matlab/R2014a.mcr
sqsub --mpp=4g -r 1.0h -o run_myprog.log ./run_myprog.sh $mcrroot
```

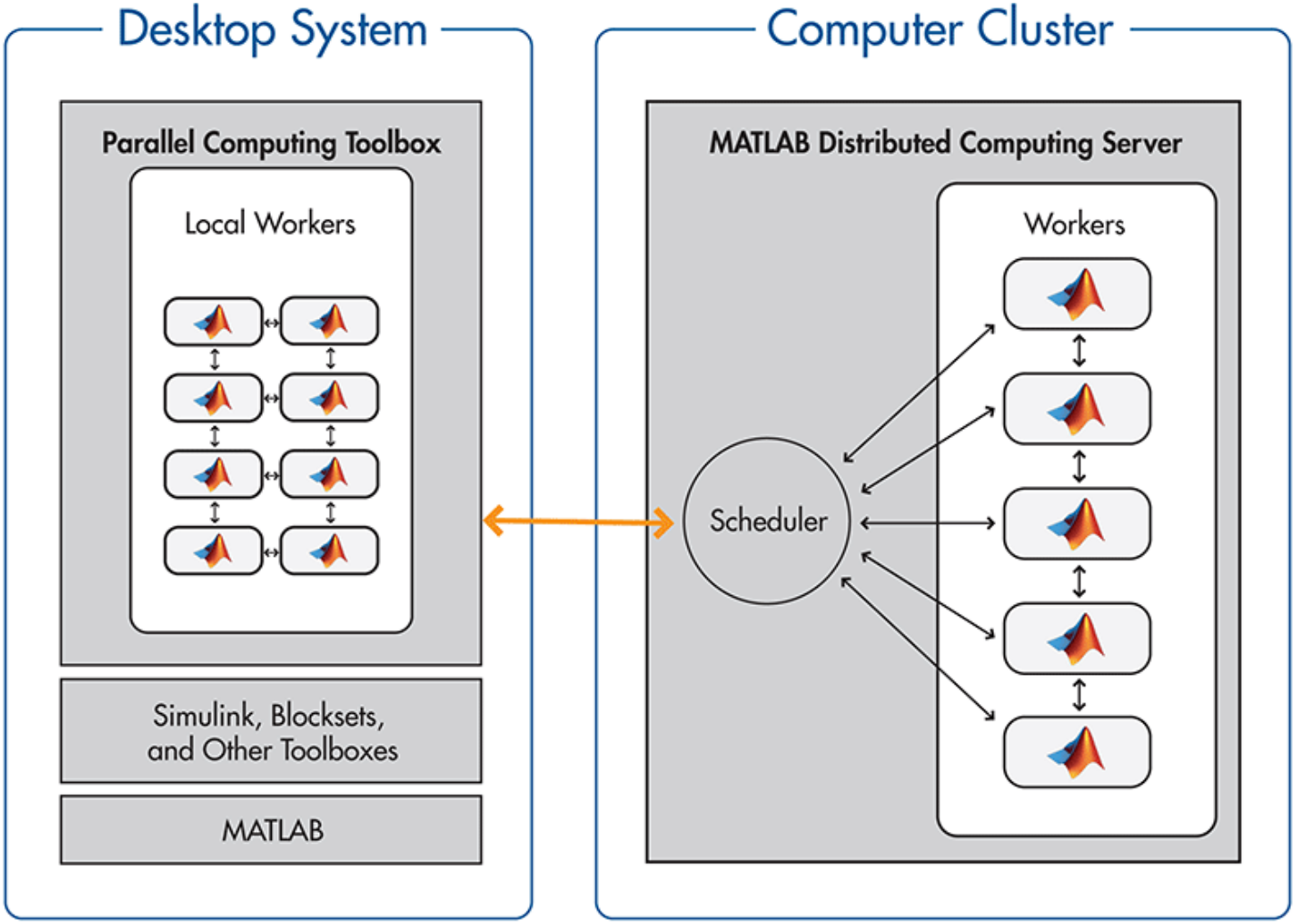
MATLAB PCT

- Server side license by SHARCNET, user group ‘matlab’

- Conditions to use PCT

  - you have a client side PCT license
  - modify your code to make use of PCT

MATLAB PCT Architecture (client-server)



Configure MATLAB and PCT on PC

- **Cluster server side (SHARCNET)**
  - setup MATLAB distributed computing server engine
  - setup ‘matlab’ queue
  - command/script for job submission

- **Client side configuration (user side)**
  - clusterInfo.m (set up cpu, memory, PATH etc., copy and modify)
  - runscript.m (copy and modify)
  - your own .m files
  - create local data directory, e.g., ‘C:\temp’ on a Windows PC
  -* create data directory on SHARCNET cluster side (e.g., scratch/userid/matlab)

Install and configure instruction in the online document
https://www.sharcnet.ca/help/index.php/MATLAB

Key Function List

- **Job Creation**
  createJob Create job object in scheduler and client
  createTask Create new task in job
  dfeval Evaluate function using cluster

- **Interlab Communication Within a Parallel Job**
  labBarrier Block execution until all labs reach this call
  labBroadcast Send data to all labs or receive data sent to all labs
  labindex Index of this lab
  labReceive Receive data from another lab
  labSend Send data to another lab
  numlabs Total number of labs operating in parallel on current job

- **Job Management**
  cancel Cancel job or task
  destroy Remove job or task object from parent and memory
  getAllOutputArguments Output arguments from evaluation of all tasks in job object
  submit Queue job in scheduler
  wait Wait for job to finish or change states

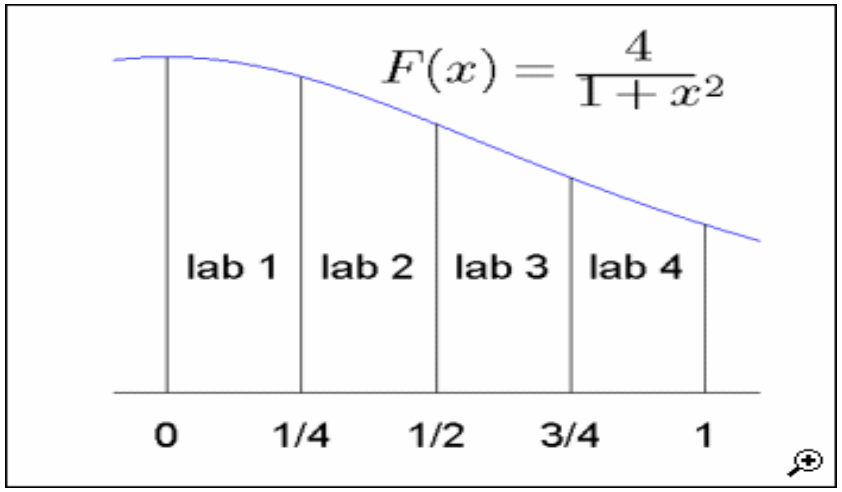
Demo: calculate pi using MATLAB

use the fact that

$$\int_0^1 \frac{4}{1+x^2} dx = 4(atan(1) - atan(0)) = \pi$$

to approximate pi by approximating the integral on the left.

divide the work between the labs by having each lab calculate the integral the function over a subinterval of [0, 1] as shown in the picture



http://www.mathworks.com/help/distcomp/examples/numerical-estimation-of-pi-using-message-passing.html

Steps

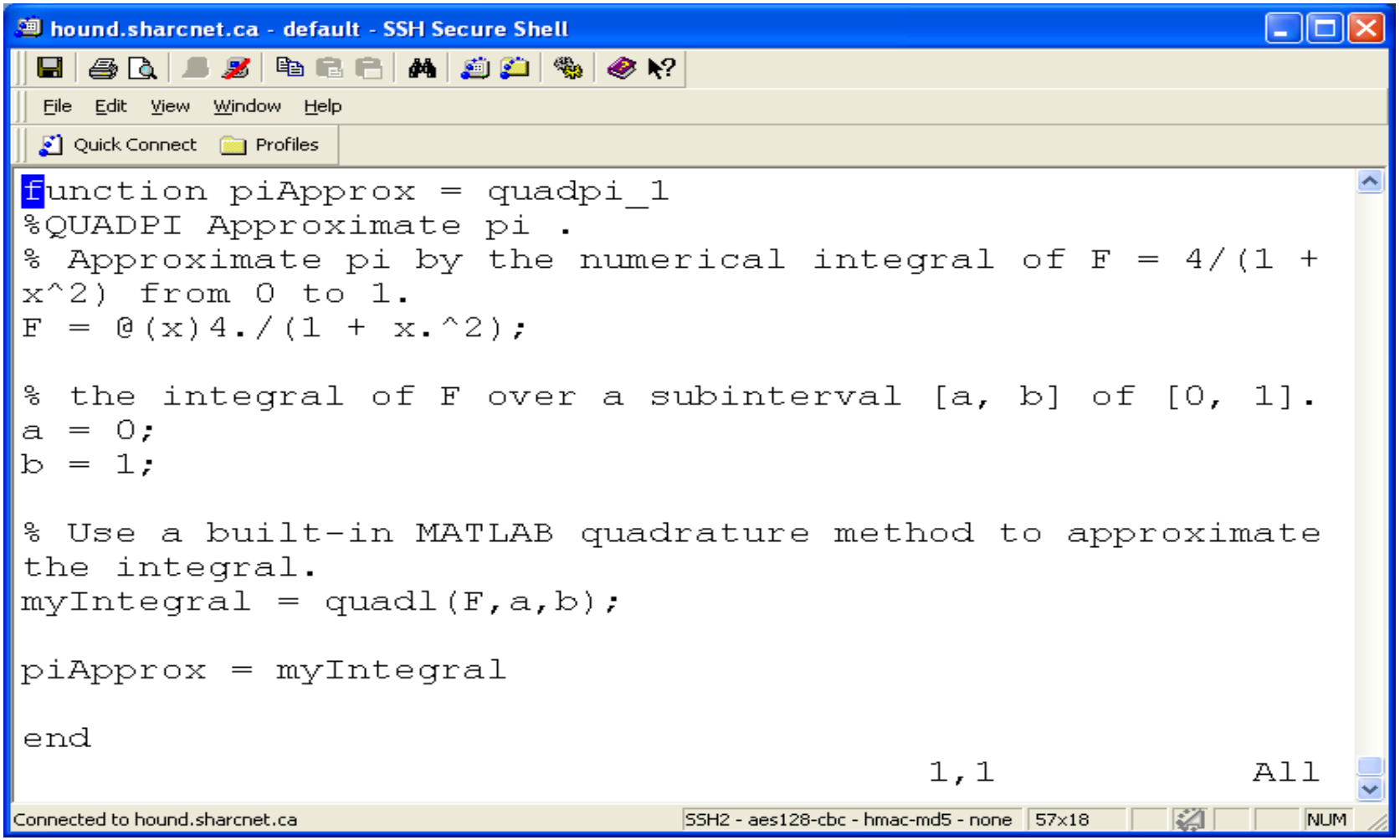
- All labs/workers will compute the same function: F=4/(1+x^2)

- Each worker/lab will calculate over a subinterval [a,b] of [0, 1], for 2 labs, the subinterval will be:
  [0, 0.50]
  [0.50, 1.0]
  a = (labindex-1)/numlabs
  b = labindex/numlabs

- Use a MATLAB quadrature method to compute the integral
  myIntegral = quadl(F, a, b)

- Add together to form the entire integral over [0,1]
  piApprox = gplus(myIntegral)

quadpi_1.m file



sqsub --mpp=2g -r 1.0h -o quadpi_1.log -i quadpi_1.m ./uwmatlab

[jemmyhu@hnd19:~/work/MATLAB/compiler] pwd
/home/jemmyhu/work/MATLAB/compiler

MCR: 1) mcc compiling

[jemmyhu@hnd19:~/work/MATLAB/compiler] ls

quadpi_1.m

[jemmyhu@hnd19:~/work/MATLAB/compiler] which mcc

/opt/sharcnet/local/matlab/R2014a/bin/mcc

[jemmyhu@hnd19:~/work/MATLAB/compiler] mcc -m -R ' -nosplash -nodisplay -nodesktop –nojvm -singleCompThread' quadpi_1.m

Warning: ignore some warning lines

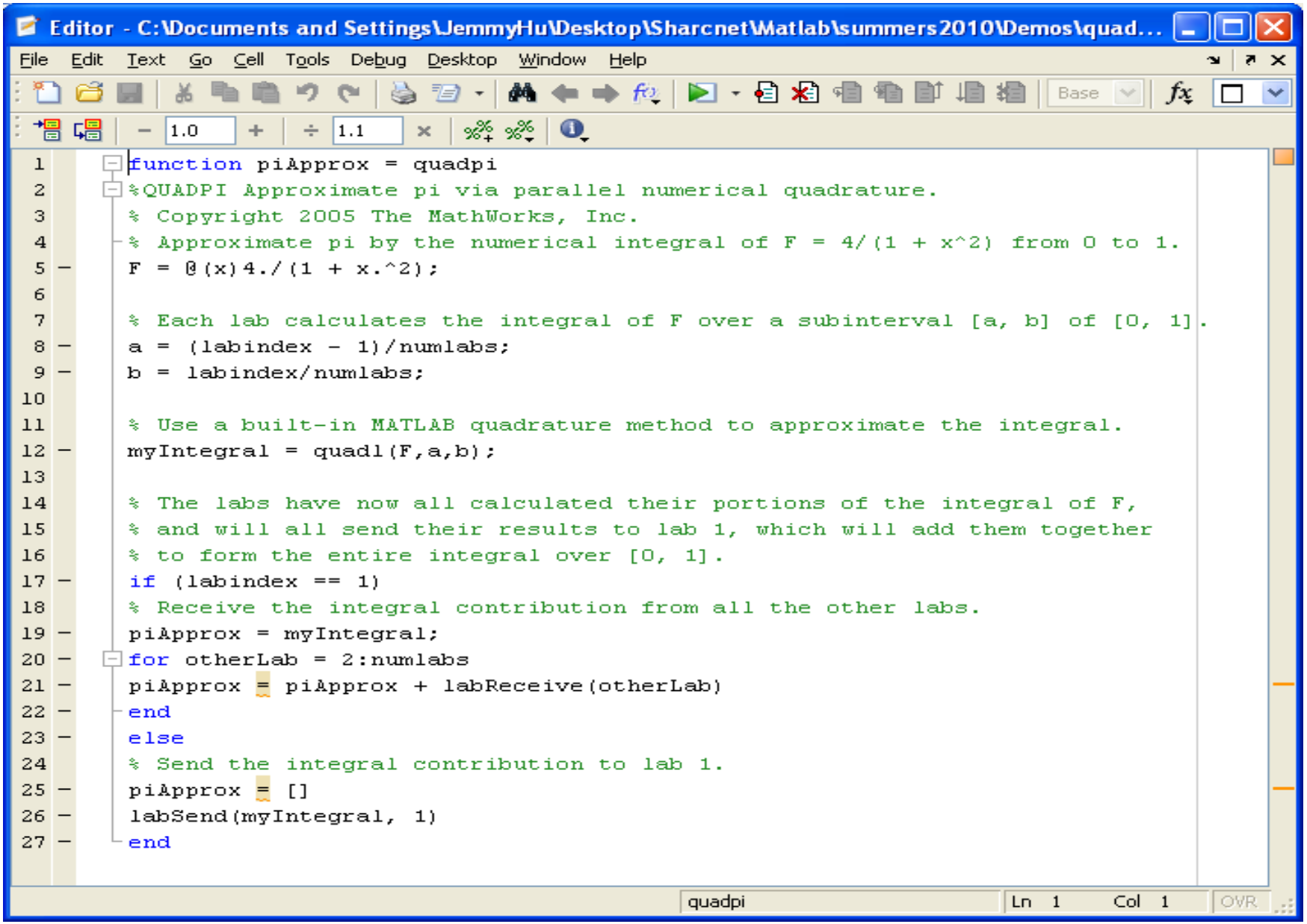
[jemmyhu@hnd19:~/work/MATLAB/compiler] ls

quadpi_1 readme.txt mccExcludedFiles.log quadpi_1.m run_quadpi_1.sh

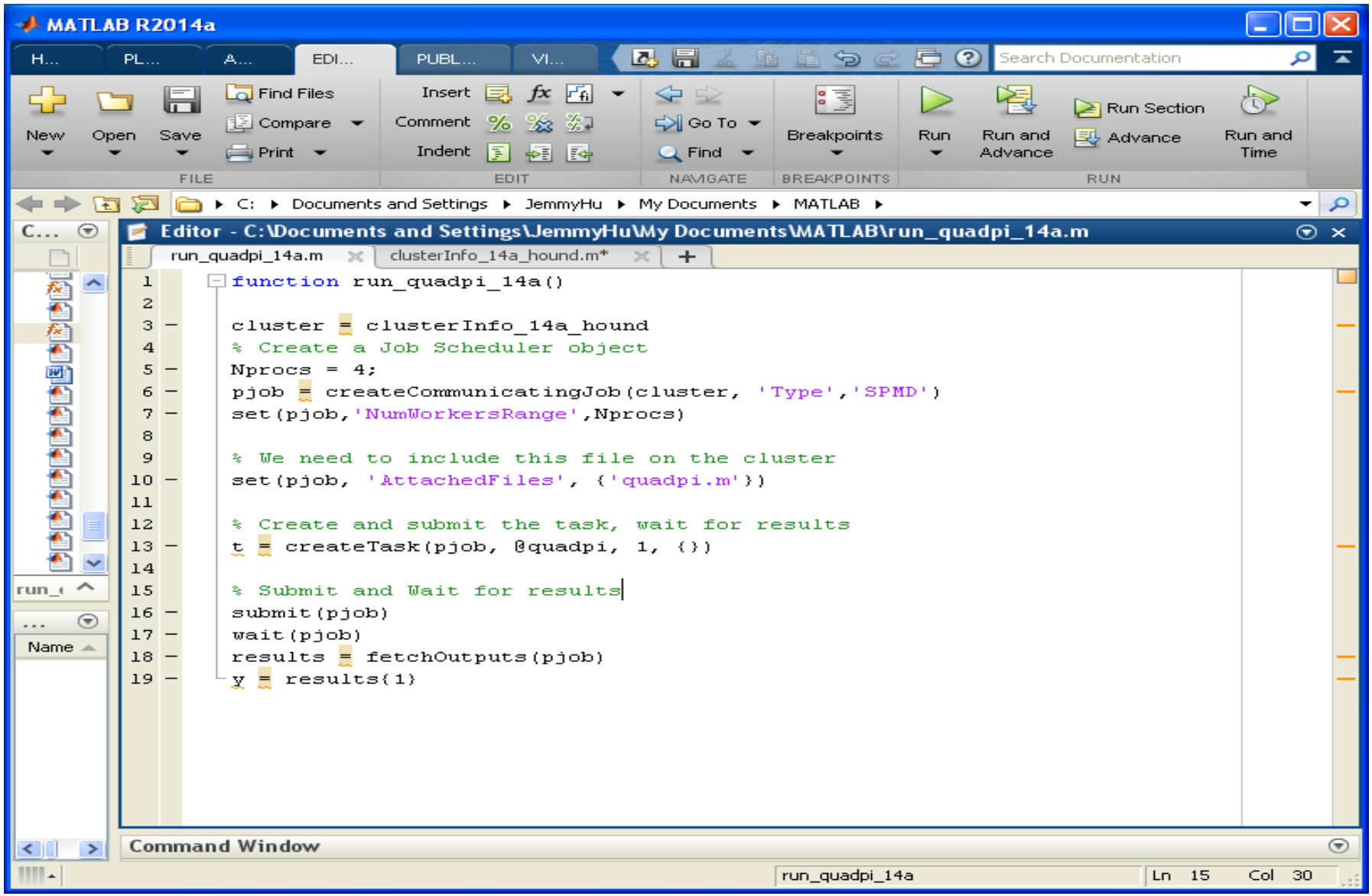
2) Run job using R2014a.mcr

[jemmyhu@hnd19:~/work/MATLAB/compiler] sqsub --mpp=4g -r 1.0h –o run_quadpi_1.log ./run_quadpi_1.sh /opt/sharcnet/local/matlab/R2014a

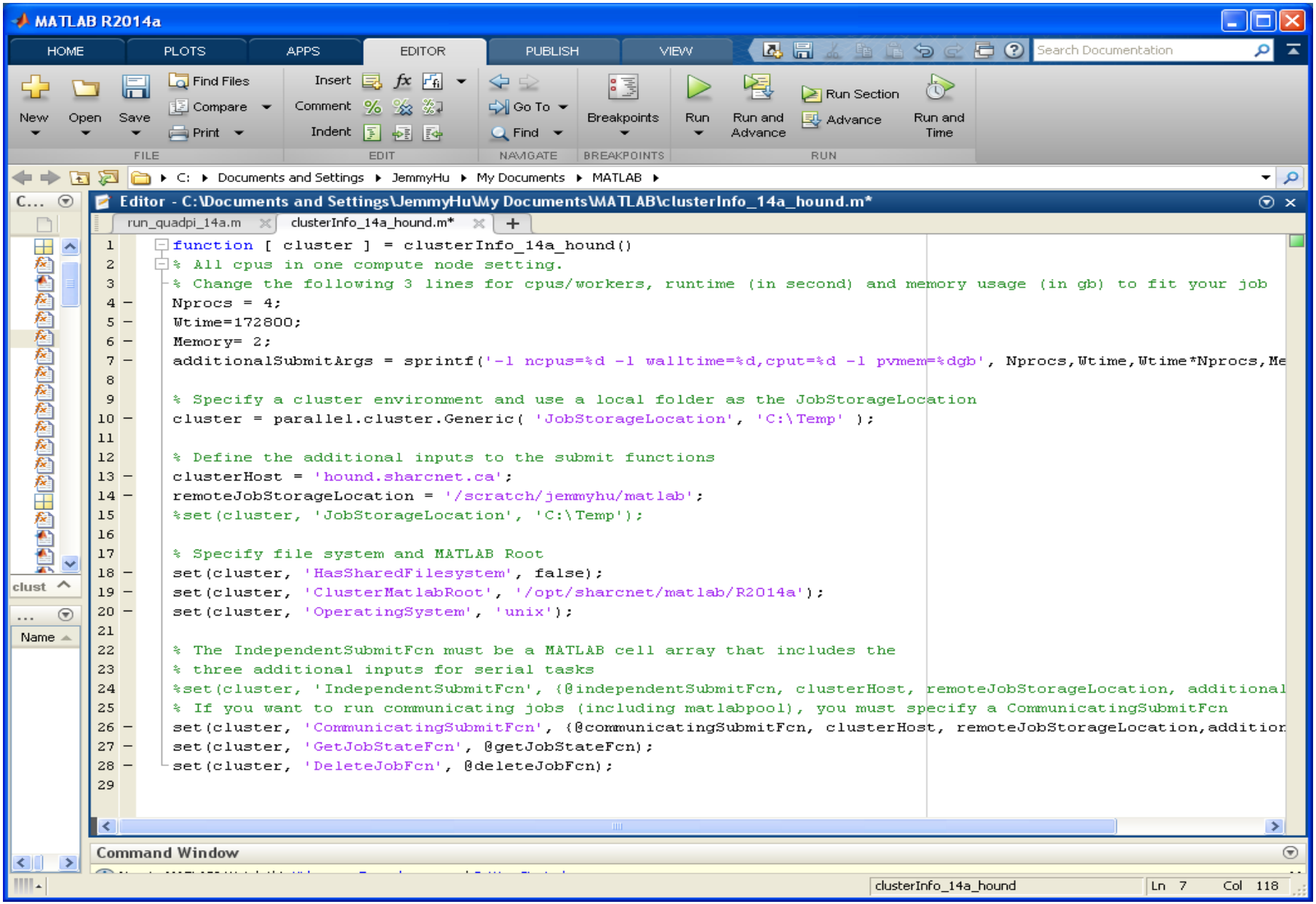
PCT: quadpi.m

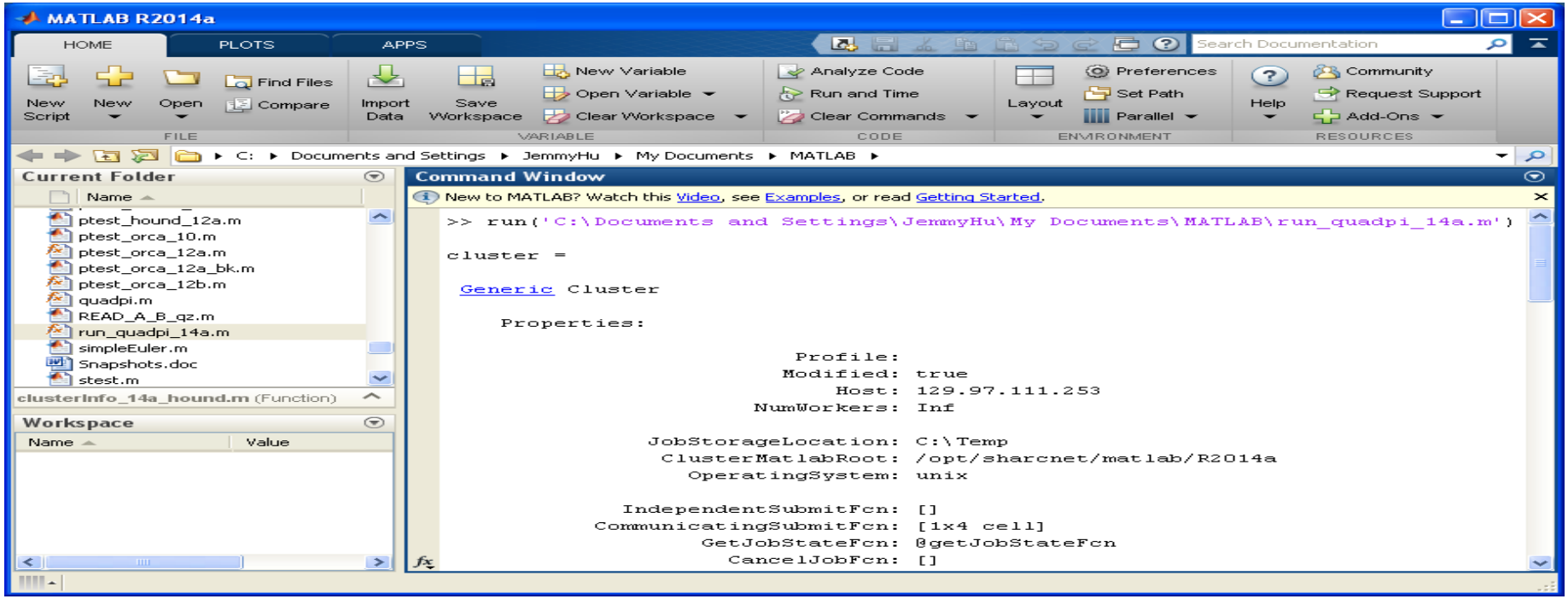

Editor - C:\Documents and Settings\JemmyHu\Desktop\Sharcnet\Matlab\summers2010\Demos\quad...
File Edit Text Go Cell Tools Debug Desktop Window Help
Base
1.0
1.1
function piApprox = quadpi
%QUADPI Approximate pi via parallel numerical quadrature.
% Copyright 2005 The MathWorks, Inc.
% Approximate pi by the numerical integral of F = 4/(1 + x^2) from 0 to 1.
F = @(x)4./(1 + x.^2);
% Each lab calculates the integral of F over a subinterval [a, b] of [0, 1].
a = (labindex - 1)/numlabs;
b = labindex/numlabs;
% Use a built-in MATLAB quadrature method to approximate the integral.
myIntegral = quadl(F,a,b);
% The labs have now all calculated their portions of the integral of F,
% and will all send their results to lab 1, which will add them together
% to form the entire integral over [0, 1].
if (labindex == 1)
% Receive the integral contribution from all the other labs.
piApprox = myIntegral;
for otherLab = 2:numlabs
piApprox = piApprox + labReceive(otherLab)
end
else
% Send the integral contribution to lab 1.
piApprox = []
labSend(myIntegral, 1)
end
quadpi
Ln 1 Col 1
OVR

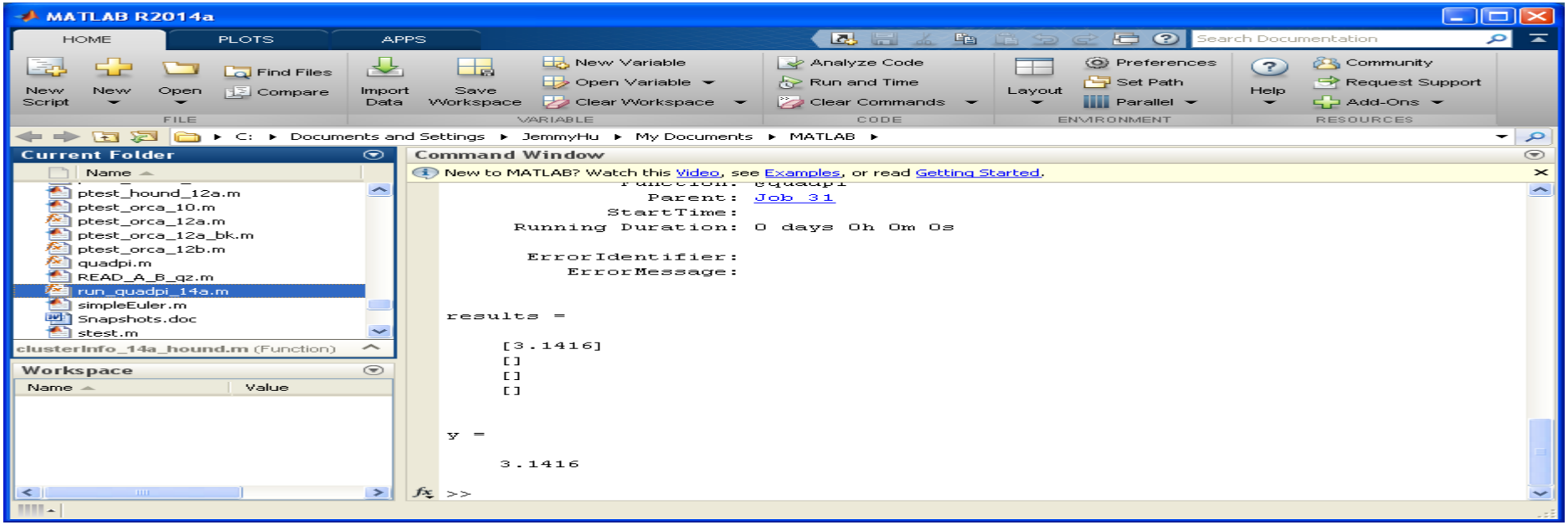
run_quadpi.m


MATLAB R2014a
Search Documentation
New
Open
Save
Find Files
Compare
Print
Insert
Comment
Indent
Go To
Find
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
EDIT
NAVIGATE
BREAKPOINTS
RUN
C: ▸ Documents and Settings ▸ JemmyHu ▸ My Documents ▸ MATLAB ▸
Editor - C:\Documents and Settings\JemmyHu\My Documents\MATLAB\run_quadpi_14a.m
run_quadpi_14a.m
clusterInfo_14a_hound.m*
1 function run_quadpi_14a()
2
3 cluster = clusterInfo_14a_hound
4 % Create a Job Scheduler object
5 Nprocs = 4;
6 pjob = createCommunicatingJob(cluster, 'Type','SPMD')
7 set(pjob,'NumWorkersRange',Nprocs)
8
9 % We need to include this file on the cluster
10 set(pjob, 'AttachedFiles', {'quadpi.m'})
11
12 % Create and submit the task, wait for results
13 t = createTask(pjob, @quadpi, 1, {})
14
15 % Submit and Wait for results
16 submit(pjob)
17 wait(pjob)
18 results = fetchOutputs(pjob)
19 y = results{1}
Name
Command Window
run_quadpi_14a
Ln 15 Col 30

clusterInfo_14a_hound.m




MATLAB R2014a
HOME
PLOTS
APPS
Search Documentation
New Script
New
Open
Find Files
Compare
Import Data
Save Workspace
New Variable
Open Variable
Clear Workspace
Analyze Code
Run and Time
Clear Commands
Layout
Preferences
Set Path
Parallel
Help
Community
Request Support
Add-Ons
FILE
VARIABLE
CODE
ENVIRONMENT
RESOURCES
C: ▸ Documents and Settings ▸ JemmyHu ▸ My Documents ▸ MATLAB ▸
Current Folder
Name
ptest_hound_12a.m
ptest_orca_10.m
ptest_orca_12a.m
ptest_orca_12a_bk.m
ptest_orca_12b.m
quadpi.m
READ_A_B_qz.m
run_quadpi_14a.m
simpleEuler.m
Snapshots.doc
stest.m
clusterInfo_14a_hound.m (Function)
Workspace
Name
Value
Command Window
New to MATLAB? Watch this Video, see Examples, or read Getting Started.
>> run('C:\Documents and Settings\JemmyHu\My Documents\MATLAB\run_quadpi_14a.m')
cluster =
Generic Cluster
Properties:
Profile:
Modified: true
Host: 129.97.111.253
NumWorkers: Inf
JobStorageLocation: C:\Temp
ClusterMatlabRoot: /opt/sharcnet/matlab/R2014a
OperatingSystem: unix
IndependentSubmitFcn: []
CommunicatingSubmitFcn: [1x4 cell]
GetJobStateFcn: @getJobStateFcn
CancelJobFcn: []


MATLAB R2014a
HOME
PLOTS
APPS
Search Documentation
New Script
New
Open
Find Files
Compare
Import Data
Save Workspace
New Variable
Open Variable
Clear Workspace
Analyze Code
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CODE
ENVIRONMENT
RESOURCES
C: ▸ Documents and Settings ▸ JemmyHu ▸ My Documents ▸ MATLAB ▸
Current Folder
Name
ptest_hound_12a.m
ptest_orca_10.m
ptest_orca_12a.m
ptest_orca_12a_bk.m
ptest_orca_12b.m
quadpi.m
READ_A_B_qz.m
run_quadpi_14a.m
simpleEuler.m
Snapshots.doc
stest.m
clusterInfo_14a_hound.m (Function)
Workspace
Name
Value
Command Window
New to MATLAB? Watch this Video, see Examples, or read Getting Started.
Function: @quadpi
Parent: Job 31
StartTime:
Running Duration: 0 days 0h 0m 0s
ErrorIdentifier:
ErrorMessage:
results =
[3.1416]
[]
[]
[]
y =
3.1416
>>