mlmc_transport

April 8, 2020

$ **Notebook MLMC Transport** $

[1]:
```
%matplotlib inline
import subprocess
import os
import sys
sys.path.append('../tools')
from plot_statistics import *
sys.path.append('../notebooks')
from tp_utilities import *
from vtk_utilities import *
import matplotlib.pyplot as plt
from starter import *
from mlmc_solution import *
sys.path.append('..')
from python.mlmc_mppy import mpp
```

[2]:
```
mpp.build()
mpp.mute=True
kernels = 32
```

```
================ build  sprng5 ================

-- libsprng.a found.

================ running cmake ================

-- Compiler option -Ofast
-- A library with BLAS API found.
-- A library with BLAS API found.
-- A library with LAPACK API found.
-- Using SuperLU 4.0
-- Time dependent problem
-- 3 dimensional problem
-- General transformations
-- Configuring done
-- Generating done
```

```
-- Build files have been written to: /home2/buchholz/mlmc/build

================ running  make ================

[  3%] Built target LIB_PS
[  5%] Built target gtest
[ 11%] Built target gtest_main
[ 14%] Built target gmock
[ 36%] Built target MLMC
[ 46%] Built target gmock_main
[ 98%] Built target SRC
[100%] Built target MLMC-M++
```

$ **Konvergenz Test** $

[ ]:
```
mpp.clean_data()
mpp.run(kernels, config='mlmc_transport_ct')
save("MLMCConvergenceTest/")
```

[ ]:
```
mpp.print_convergence_table()
```

[ ]:
```
mpp.show_convergence_table()
```

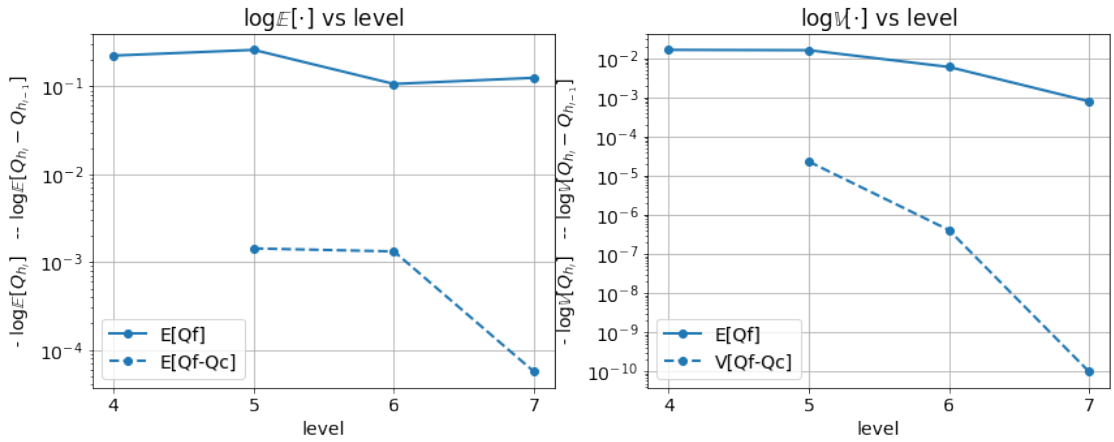
$ **MLMC Experiment epsilon = 0.01** $

[ ]:
```
mpp.clean_data()
kwargs = {'epsilon':'0.01','initLevels':'4,5,6','initSampleAmount':'8,4,2'}
mpp.run(kernels, config='mlmc_transport',kwargs=kwargs)
save("MLMCExperiment/"+kwargs['epsilon']+"/")
```

[12]:
```
statistics = read_log('../results/MLMCExperiment/0.01/log')
display(statistics)
```

```
     M  E[Qf-Qc]     E[Qf]      V[Qf-Qc]     V[Qf]  kurtosis       cost
l
4  378  0.225017  0.225017  1.610760e-02  0.016108  2.991300     294912
5    6  0.001429  0.261486  2.279820e-05  0.015813  3.923450    2359300
6    2  0.001321  0.106957  4.096720e-07  0.005909  1.000000   18874400
7    2  0.000056  0.125627  1.000000e-10  0.000784  0.110661  150995000
```

[13]:
```
plot_statistics(statistics, ['E[Qf]','V[Qf]'], None)
```



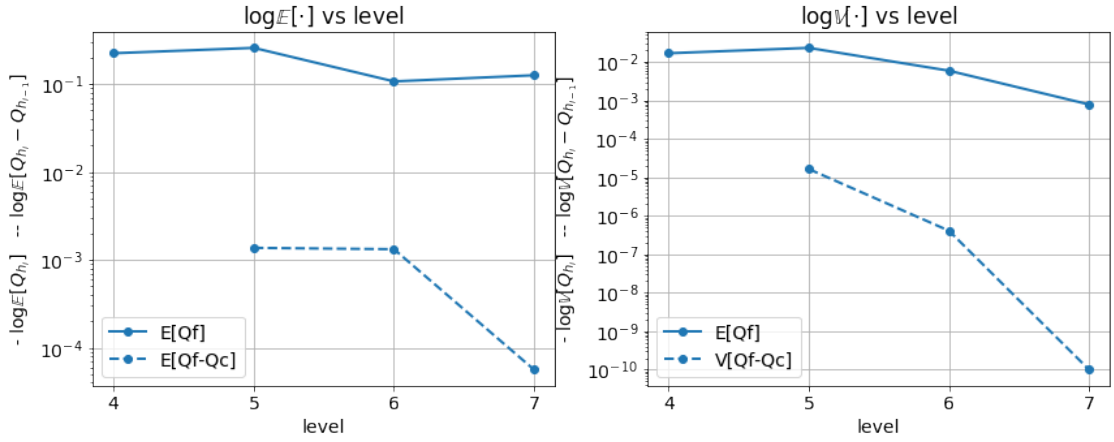
$ MLMC Experiment epsilon = 0.005 $

[ ]:
```
mpp.clean_data()
kwargs = {'epsilon':'0.005','initLevels':'4,5,6','initSampleAmount':'8,4,2'}
mpp.run(kernels, config='mlmc_transport',kwargs=kwargs)
save("MLMCExperiment/"+kwargs['epsilon']+"/")
```

[14]:
```
statistics = read_log('../results/MLMCExperiment/0.005/log')
display(statistics)
```

l	M	E[Qf-Qc]	E[Qf]	V[Qf-Qc]	V[Qf]	kurtosis	cost
4	1539	0.223618	0.223618	1.678900e-02	0.016789	2.863540	294912
5	22	0.001368	0.257407	1.640940e-05	0.023179	3.119730	2359300
6	2	0.001321	0.106957	4.096720e-07	0.005909	1.000000	18874400
7	2	0.000056	0.125627	1.000000e-10	0.000784	0.110661	150995000

[15]:
```
plot_statistics(statistics, ['E[Qf]','V[Qf]'], None)
```



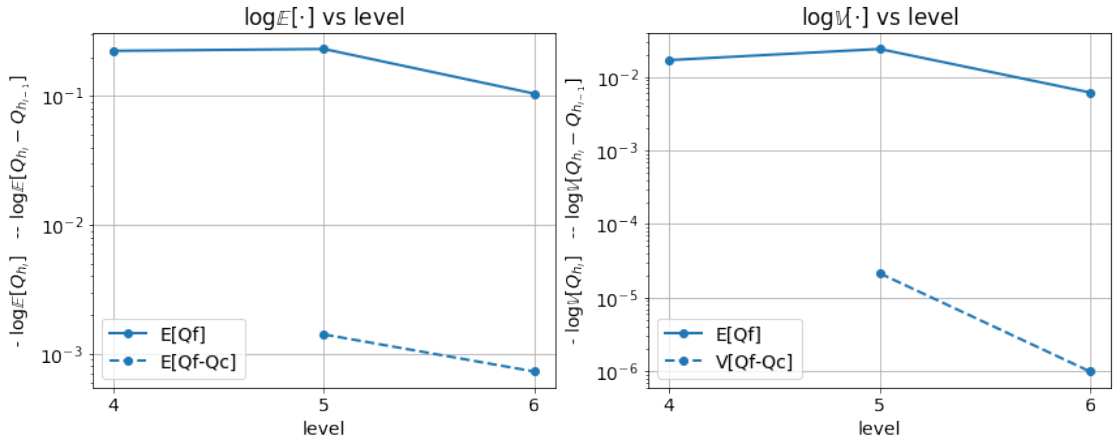
$ **MLMC Experiment epsilon = 0.003** $

[ ]:
```
mpp.clean_data()
kwargs = {'epsilon':'0.003','initLevels':'4,5,6','initSampleAmount':'8,4,2'}
mpp.run(kernels, config='mlmc_transport',kwargs=kwargs)
save("MLMCExperiment/"+kwargs['epsilon']+"/")
```

[16]:
```
statistics = read_log('../results/MLMCExperiment/0.003/log')
display(statistics)
```

l	M	E[Qf-Qc]	E[Qf]	V[Qf-Qc]	V[Qf]	kurtosis	cost
4	4374	0.224298	0.224298	1.693870e-02	0.016939	2.75002	294912
5	59	0.001411	0.231847	2.145810e-05	0.023991	2.59309	2359300
6	5	0.000727	0.104317	9.886560e-07	0.006146	1.66323	18874400

[17]:
```
plot_statistics(statistics, ['E[Qf]','V[Qf]'], None)
```



$ **MLMC Experiment epsilon = 0.001** $

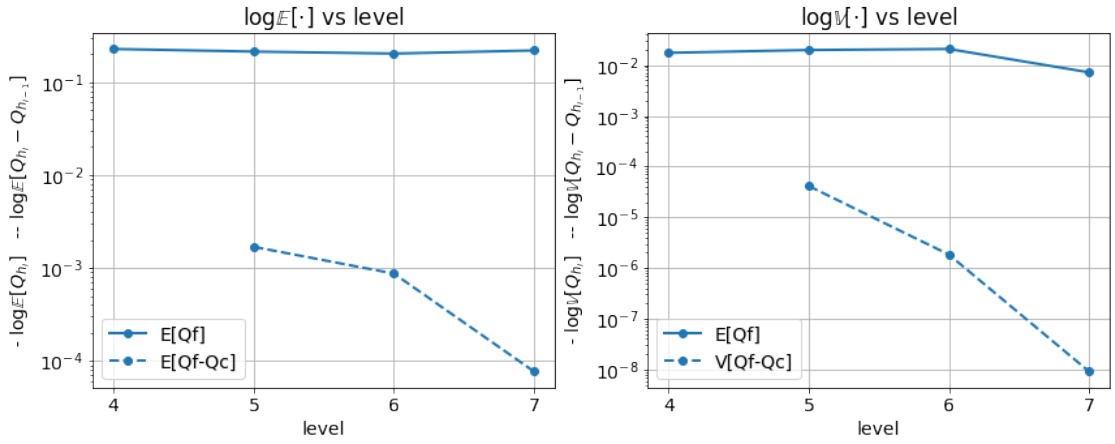
[ ]:
```
mpp.clean_data()
kwargs = {'epsilon':'0.001','initLevels':'4,5,6','initSampleAmount':'8,4,2'}
mpp.run(kernels, config='mlmc_transport',kwargs=kwargs)
save("MLMCExperiment/"+kwargs['epsilon']+"/")
```

[18]:
```
statistics = read_log('../results/MLMCExperiment/0.001/log')
display(statistics)
```

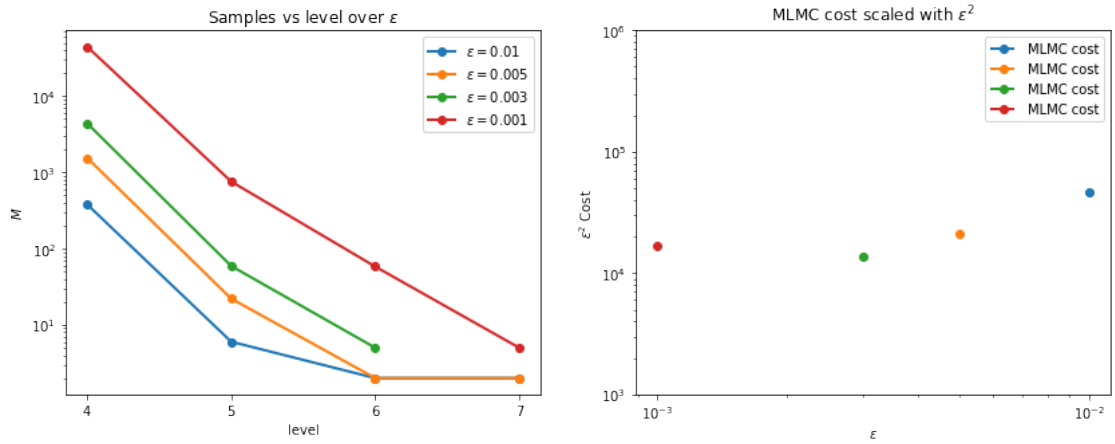
l	M	E[Qf-Qc]	E[Qf]	V[Qf-Qc]	V[Qf]	kurtosis	cost

4	44254	0.226394	0.226394	1.743050e-02	0.017431	2.65924	294912
5	755	0.001687	0.212340	4.127960e-05	0.019814	3.68994	2359300
6	58	0.000869	0.202110	1.839350e-06	0.020755	3.80032	18874400
7	5	0.000077	0.218324	9.122700e-09	0.007189	2.45257	150995000

[19]:
```
plot_statistics(statistics, ['E[Qf]','V[Qf]'], None)
```



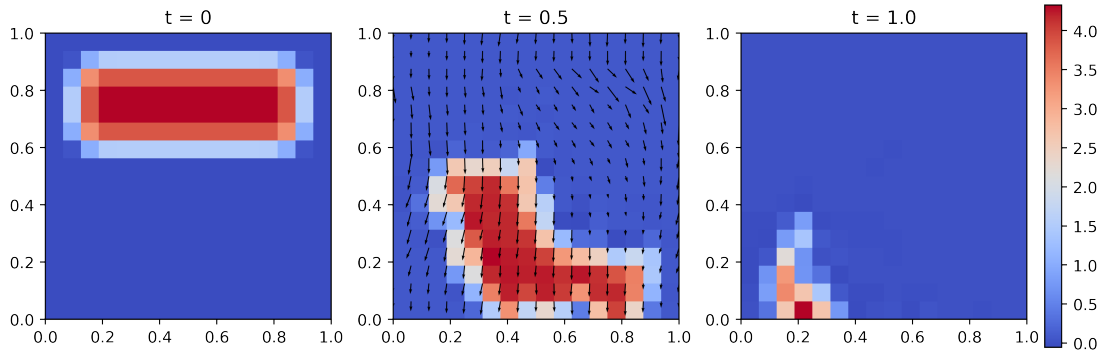
[3]:
```
wd = '/../../results/MLMCExperiment/'
log_files = ['0.01/log','0.005/log','0.003/log','0.001/log']
mpp.show_combined_mlmc_table(log_files= log_files, wd = wd )
```



$ **Beispielsamples**$

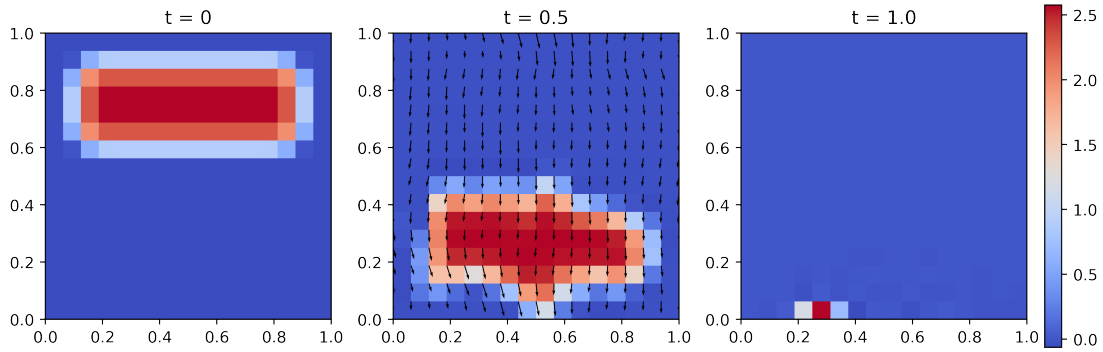
$ **Level 4 (baselevel)** $

[4]:
```
solution_3(wd="../results/MLMCExperiment/0.001/vtk/",sample="sample_4_1/
 ↪",quiver_filter=1,quiver_scale=0.10)
```

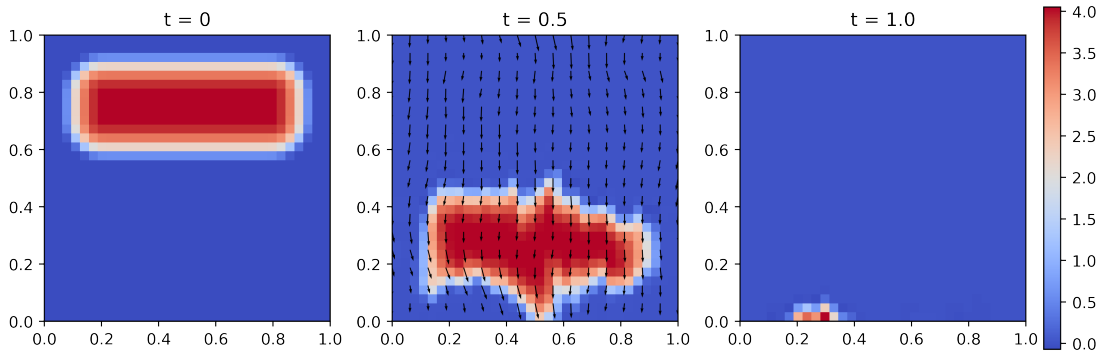


$ Level 5 (und zugehöriges Vergleichssample auf Level 4) $

[5]:
```
solution_3(wd="../results/MLMCExperiment/0.001/vtk/",sample="sample_coarse_5_1/
 ↪",quiver_filter=1,quiver_scale=0.10)
```

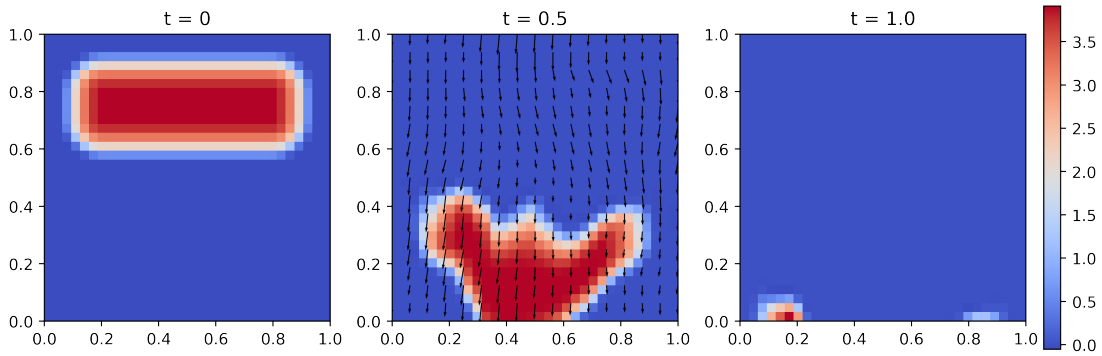


[6]:
```
solution_3(wd="../results/MLMCExperiment/0.001/vtk/",sample="sample_5_1/
 ↪",quiver_filter=2,quiver_scale=0.10)
```

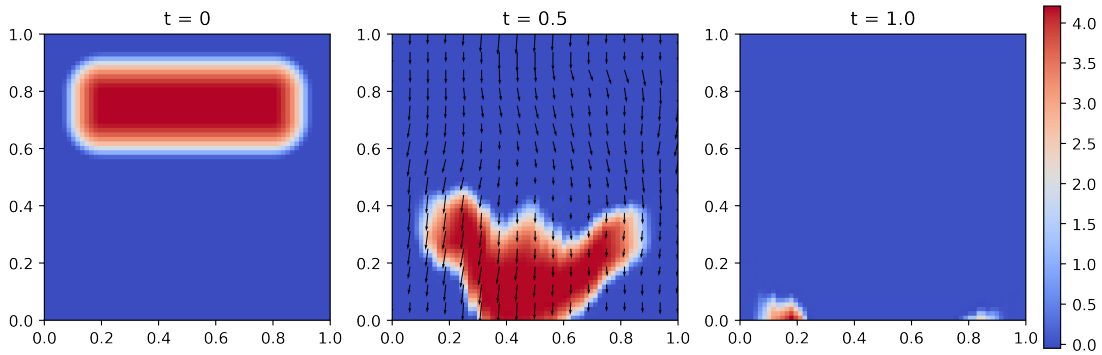


$ Level 6 (und zugehöriges Vergleichssample auf Level 5) $

[7]:
```
solution_3(wd="../results/MLMCExperiment/0.01/vtk/",sample="sample_coarse_6_0/
 ↪",quiver_filter=2,quiver_scale=0.12)
```

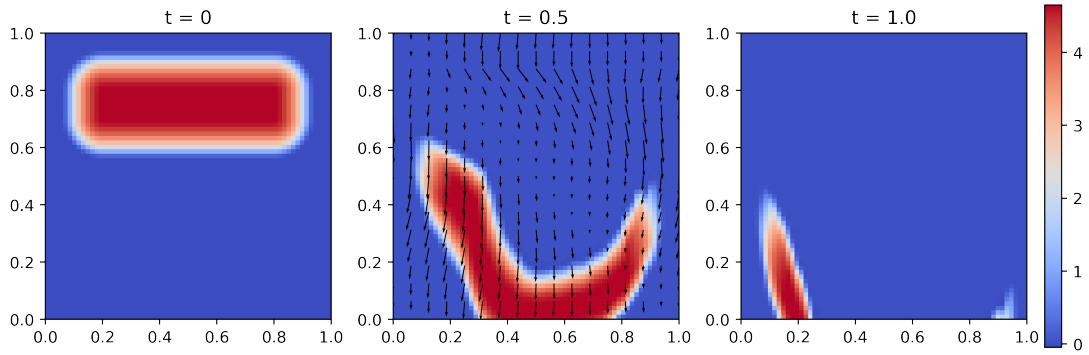


[8]:
```
solution_3(wd="../results/MLMCExperiment/0.01/vtk/",sample="sample_6_0/
 ↪",quiver_filter=4,quiver_scale=0.12)
```

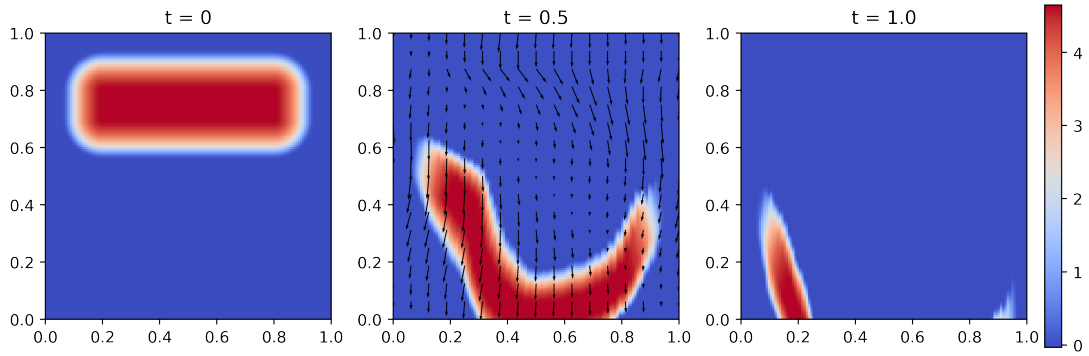


$ **Level 7 (und zugehöriges Vergleichssample auf Level 6)** $

[9]:
```
solution_3(wd="../results/MLMCExperiment/0.01/vtk/",sample="sample_coarse_7_0/
 ↪",quiver_filter=4,quiver_scale=0.12)
```



[10]:
```
solution_3(wd="../results/MLMCExperiment/0.01/vtk/",sample="sample_7_0/
 ↪",quiver_filter=8,quiver_scale=0.12)
```



[ ]:
```
result = tail("../results/MLMCExperiment/0.001/log",n=22)
levels, sample_amount = parse_nofsamples(result)
mlmcmeshes(working_dir="../results/MLMCExperiment/0.001/vtk/
 ↪",levels=levels,sample_amount=sample_amount)
```

$ **Lösung im MLMC Sinne basierend auf gegegebem Zielfunktional (hier Masse zum Zeitpunkt t = 1.0)**$

[ ]:
```
solution_3(wd="../results/MLMCExperiment/0.001/vtk/",sample="mlmc/
↪",quiver_filter=8,quiver_scale=0.12)
```

[ ]:
```

```