MILC Code Basics

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Super.
got milc?

Mathias Gruenewald: Temptation of St Anthony (1515)

MILC Code Capabilities

- Molecular dynamics evolution
  - Staggered fermion actions (Asqtad, Fat7, HISQ, etc)
  - Clover fermion action
  - Pure gauge
  - Schroedinger functional
- Hadron spectroscopy
  - Staggered mesons and baryons
  - Clover mesons and baryons
  - Mixed staggered/clover mesons
  - Static/light spectroscopy
  - Quarkonium spectroscopy (S and P-wave)
- Current matrix elements
  - Leptonic decay (fpi, fB, fD)
  - Semileptonic decay (heavy-light)
- Miscellaneous
  - Topological charge
  - Dirac matrix eigenvectors and eigenvalues
  - Nonperturbative renormalization of currents

Supported File Formats

- Gauge configuration file formats
  - MILC, SciDAC (ILDG), NERSC, Fermilab
- Dirac propagator file formats
  - USQCD, Fermilab
- Staggered propagator file formats
  - USQCD, MILC, Fermilab

Supported SciDAC C-Coded Packages

- QIO (I/O)
- QMP (Message passing)
- QLA (linear algebra – single processor)
- QDP/C (linear algebra – data parallel)
- QOPQDP (“Level 3” optimized)
- (More in the next session)

http://usqcd.jlab.org/usqcd-software/

Precision

- Global single or double precision
- Mixed precision in some applications

Portability

- Practically any scalar machine
- Any MPP machine with MPI
- QCDOC

MILC Code Organization

- Application directories
  - With compilation targets
- Library directory
  - Linear algebra routines
- Shared procedures (“generic”) directories
  - Shared across applications

MILC Code Organization

- Application directories: examples
  - cd ks_imp_dyn (application)
    - make su3_rmd (target) (Asqtad R algorithm)
    - make su3_spectrum (another target) (staggered spectroscopy)
  - cd ks_imp_rhmc (application)
    - make su3_rhmc (Asqtad RHMC algorithm)
    - make su3_rhmc_hisq (target) (HISQ algorithm)
  - cd clover_invert2 (application)
    - make su3_clov (clover spectroscopy, etc.)

MILC Code Organization

- Shared procedures directories: examples
  - generic

    (common to all applications)
  - generic_ks

    (common to staggered fermion applications)
  - generic_wilson

    (common to clover and Wilson fermion apps)

Building the MILC Code

- Download source
  http://www.physics.utah.edu/~detar/milc_qcd.html
- Unpack
- Configure
- Build
- Check

Building the MILC Code

- Unpack
  - **`gzip –d milc_qcd-7.6.2.tar.gz`**
  - **`less README_UNPACK`**
  - **`make –f Make_unpack ks_imp_rhmc`**

Building the MILC Code

- Configure (crude old fashioned!)
  - Copy default Makefile to application directory
    - **`cd ks_imp_rhmc`**
    - **`cp ../Makefile .`**
  - Edit (example in next slide)
    - **`Makefile`**
    - **`../libraries/Make_vanilla`**
    - **`../include/config.h`**

```
#-------------------------------------------------------------------
# 1. Architecture

# Compiling for a parallel machine?  Uncomment this line.
#MPP = true

# Cross-compiling for the QCDOC?  blank if we are not.
# For the QCDOC, be sure to source the QOS setup script before running make,
# and be sure to set MPP = true
#QCDOC = true

#-------------------------------------------------------------------
# 2. Precision

# 1 = single precision; 2 = double
PRECISION = 1

#-------------------------------------------------------------------
# 3. Compiler
# Choices include mpicc cc gcc pgcc g++

ifeq ($(strip ${MPP}),true)
  CC = /usr/local/mvapich/bin/mpicc
else
  CC = gcc
endif
```

Building and Checking the Code

- Build
  - **`make su3_rmd`**
- Check single precision su3_rmd
  - **`make check "PROJS=su3_rmd" "PRECLIST=1"`**
- Check all targets in this directory
  - **`make check`**

Running the code

- **`su3_rhmc < inputfile > outputfile`**
- **`su3_rhmc inputfile > outputfile`**
- **`su3_rhmc inputfile outputfile`**

Sample parameter input (su3_rmd)

```
prompt 0
nflavors1 2
nflavors2 1
nx 16
ny 16
nz 16
nt 64
iseed 5682304

warms 0
trajecs 2
traj_between_meas 1
beta 6.76
mass1 0.05
mass2 0.5
u0   0.8441
microcanonical_time_step 0.02
steps_per_trajectory 4
max_cg_iterations 300
max_cg_restarts 5
error_per_site .000005
error_for_propagator .000002
reload_serial lat.sample.milc
save_serial_scidac lat.test.scidac
```

molecular dynamics

measurements

Summary

- The MILC code is versatile and portable
- I have given a brief overview of the code structure
- I have touched on the process of building and running the code

Tutorial 1 Goals

- Run precompiled code
- Modify the input parameters
- Build a different target
- Modify the Makefile and build
- Download and unpack the code (if time)