Pencil Code: progress since August 2006

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Wolfgang Dobler (Univ. Calgary)
Anders Johansen (MPIA, Heidelberg)
Antony Mee (Univ. Newcastle)
Nils Haugen (NTNU, Trondheim)
and many more....

(...just google for Pencil Code)
Pencil Code

- Started in Sept. 2001 with Wolfgang Dobler
- High order (6\textsuperscript{th} order in space, 3\textsuperscript{rd} order in time)
- Cache & memory efficient
- MPI, can run PacxMPI (across countries!)
- Maintained/developed by many people (CVS!)
- Automatic validation (over night or any time)
- Max resolution so far 1024\textsuperscript{3}, 256 procs
Progress since last time

Pencil Code User Meeting

Copenhagen, Denmark, 13-15 July 2006

Sponsored and organized by Nordita

A 3-day workshop on `Pencil Code User Meeting' in Copenhagen, 13-15 July 2006

Background and Purpose

Lots of things have happened recently with the code, and so we need to think about streamlining our efforts. The previous Pencil Code Workshop, which was a year ago, has been extremely fruitful in making the code more coherent. The plan for this workshop is to discuss improvements concerning the coherence and useability of the code. One of the things that can hopefully be sorted out by then concerns the handling of temperature in dimensionful and nondimensional runs.

The plan is to have Pencil Code User Meetings every year. So, don't worry if you miss this years chance, there are already plans for the next meeting in Stockholm in 2007.
TarBall versions since 2002

Pencil Code TarBalls

Note: the tarballs are by definition *always* outdated. Occasionally, the tarballs are even *extremely* outdated. We *strongly* encourage you to either avoid them and use cvs, or to update the tarballs via cvs (which is equivalent).

pencil-code_1.4.tar.gz (2.6M, 8 Aug 2007, :pserver:anonymous@130.225.213.198:/var/cvs/pencil-public)
pencil-code_1.3.tar.gz (2.6M, 11 Jun 2007, :pserver:anonymous@130.225.213.198:/var/cvs/pencil-public)
pencil-code_1.2.tar.gz (2.5M, 6 May 2007)
pencil-code_1.1.tar.gz (2.0M, 22 Jul 2006)
pencil-code_1.0.tar.gz (1.7M, 1 Nov 2005)
pencil-code_0.96b.tar.gz (1.4M, 26 Aug 2004)
pencil-code_0.96.tar.gz (1.4M, 6 Aug 2004, has a bug in MPI)
pencil-code_0.95.tar.gz (1.1M, 13 Jan 2004)
pencil-code_0.9.tar.gz (541K, 2 Jan 2003)
pencil-code_0.8.tar.gz (377K, 23 Sep 2002)

$Date: 2007/08/08 06:57:48 $, $Author: brandenb $, $Revision: 1.4 $
Increase in # of auto tests
Pencil Code check-ins

timestep
start
register
radiation_ray
radiation_exp
pscalar
power_spectrum
param_io
Makefile
magnetic
ionization
interstellar
initcond
hydro
forcing
equ
entrpwy

2002  2003  2004  2005  2006  2007  2008
## CVS annotate per UserId

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<tr>
<td>brandenb</td>
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<tr>
<td>ajohan</td>
<td>18907</td>
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Faster and bigger machines
256 processor run at $1024^3$
Hyperviscous, Smagorinsky, normal

Inertial range unaffected by artificial diffusion

height of bottleneck increased
onset of bottleneck at same position
Ma=10 supersonic turbulence

\[ \text{div} u \]

\[ t = 35.05 \]
MRI turbulence
MRI = magnetorotational instability

256³
w/o hypervisc.
t = 600 = 20 orbits

512³
w/o hypervisc.
Δt = 60 = 2 orbits
Same conditions??

6th order

2nd order

Work per processor

Work per processor

$N_{proc}$

$N_{proc}$
... I would be most interested in also learning whether you think that your pencil code may scale to use say a petascale machine that might have 800,000+ processor cores, for that is right now being discussed as an NSF facility to become available in early 2012. Trials with smaller machines (about 50,000 processors) are soon to begin, most notably here at UT Austin....
ACCELERATING DISCOVERY IN SCIENCE AND ENGINEERING THROUGH PETASCALE SIMULATIONS AND ANALYSIS (PetaApps)

CONTACTS

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HPC Systems

Sun Linux Cluster☆Dell Linux Cluster☆IBM Power5 System☆Condor Pool☆Operations

Dell Dual-Core Linux Cluster

System Name: Lonestar
Host Name: isol01.tacc.utexas.edu
IP Address: 129.114.50.31 & .32
Operating System: Linux
Number of Processors: 5,840 (compute)
Total Memory: 11.6 TB
Peak Performance: 62 TFLOPS
Total Disk: 106.5TB(local), 70TB(global)

Description:
The TACC Dell Linux Cluster contains 5,840 cores within 1,460 Dell PowerEdge 1955 compute blades (nodes), 16 PowerEdge 1850 compute-I/O server-nodes, and 2 PowerEdge2950 (2.66GHz) login/management nodes. Each compute node has 8GB of memory, and the login/development nodes have 16GB. The system storage includes a 70TB parallel (NFS) Lustre file system, and 106.5TB of local disk storage.