Chemora!
Hands On Exercises

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EDL: Equation Definition Language

- Easy to parse

- Easy to read

- Uses English begin/end for blocks

- Specifies parts of the thorn, where to run

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EDL: Equation Definition Language

- Equations typed in "natural" form

    ◇ * or space means multiply (but not newline)

    ◇ parenthesis are used to group or call a function

    ◇ D_x means partial x derivative

    ◇ D_t means partial t derivative, use on the LHS

    ◇ ˆ is used for upper indices, _ is for lower

    ◇ ** is used for exponents

    ◇ implied summation is used

- "Natural" means different things to different people

A Basic EDL Script

```
begin thorn SimpleWaveScriptCaKernel

use cakernel

# This is a comment

begin parameters
  amp : real "The amplitude of the wave",
    default: 1.0, range: -infinity to infinity
  kfac : real "The wave number", default: 2 PI, range: 0 to 10 PI
  c0 : real
end parameters

begin calculation initial_sine_calc scheduled at initial
  phi =  amp        sin(kfac x) cos( kfac c0 t)
  pi  = -amp c0 kfac sin(kfac x) sin( kfac c0 t)
end calculation
```

A Basic EDL Script

```
begin calculation calc_rhs scheduled at MoL_CalcRHS
  D_t phi = pi
  D_t pi = c0**2 D_xx phi
end calculation


begin calculation calc_bound_rhs scheduled at MoL_CalcRHS on boundary
  D_t phi = pi
  D_t pi =  -c0**2 kfac**2 phi
end calculation


begin variables
  phi pi
end variables
end thorn
```

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Setting Up

Login to Shelob (shelob.hpc.lsu.edu)

User Name: (hpctrn01 to hpctrn20)

Password (see board)

Your .soft should contain +mathematica-9.0

After adding it, type "resoft"

cd /work/$LOGNAME/ChemoraET15

Modifying the Wave Equation

sh edl_wave.sh

Edit the file

make

qsub -I -l walltime=0:05:00 -l nodes=1:ppn=16 -q checkpt

cd /work/$LOGNAME/ChemoraET15

mpirun -np 1 ./exe/cactus_sim simplewave.par

exit # Neither "vi" nor "make" work properly on a compute node

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Visualizing the Data

After running you should have files such as ./simplewave/phi.xl

You can visualize them with gnuplot

```
$ scp hpctrn01@shelob.hpc.lsu.edu:/work/hpctrn01/ChemoraET15/simplewave/phi.xl .

gnuplot> plot "phi.xl" i 0 using 10:13 with linespoints

gnuplot> plot "phi.xl" i 1 using 10:13 with linespoints
```

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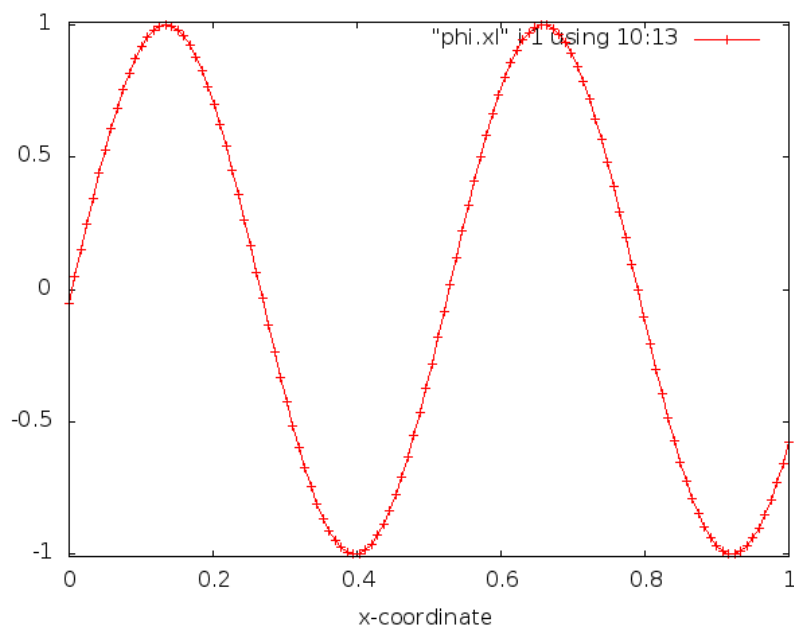
Visualizing the Data

Alternatively, create a movie with wave_movie.pl

Use scp to fetch it from shelob on /home/sbrandt/bin/wave_move.pl

type "wave_movie.pl file" to create a movie using gnuplot and mencoder.

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Suggested Edits

Replace "D_xx" with "Euc^ij D_ij"

Modify the RHS, "D_t phi = pi + vamp exp(-sigma ((x-xv0)**2))"

   ...add parameters such as vamp as needed

Set "D_t pi = boundx" in the boundary condition

   boundx = -1, 0, or 1

Show Tuning Decisions

Try uncommmenting the show tuning flag:

CaKernel::dynamic_compile_show_tuning_decisions = yes

```
Calculation initial_sine_calc finalized.
 Total 141, (vis,ctc,ident, eable,remap) (9,29,1, 6,0)
 Optimizations: (ident_op, zero_mult, neg_mult) (1,0,0)
             : (comb,distr,cfact)  (0,0,0)
INFO (CaCUDALib): Chemora Code Generation Report for initial_sine_calc
    :       Tile   Iter B    FP/Insn  IK    Elts  Issue  Data   Lat      ET  OV  H/I
  0: 120, 8, 1  10 z G     2/   3   0     3.0    0.1   1.0   0.5    7.1   0 1.00
 Total of  1  (    0)       2/   3   0     3.0    0.1   1.0   0.5    7.1
```

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