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#      PETSc Hands On Session.      #
#      ACTS Workshop 2009          #
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## A copy of this document will be available on bassi.nersc.gov at
## ~balay/petsc-acts09-hands-on.txt. This can be used for copy/paste of
## commands to avoid typos.

## Log on to bassi.nersc.gov using ssh with X11 forwarding. This
## is needed for some of the graphical examples. [This also
## assumes you have a X11 Server running on your desktop/laptop]

#* ssh -X bassi.nersc.gov

## The current release version of PETSc is 3.0.0 This version can be
## accessed on bassi with the following:
module add petsc/3.0.0

## PETSC_ARCH and PETSC_DIR are 2 env variables that are normally used.
## Verify that these values are set by the module command.
echo $PETSC_ARCH
echo $PETSC_DIR

## Copy a couple of linear and nonlinear example files from PETSc
## source directory.

mkdir -p $HOME/petsc-handson/ksp
cp $PETSC_DIR/src/ksp/ksp/examples/tutorials/makefile $HOME/petsc-handson/ksp
cp $PETSC_DIR/src/ksp/ksp/examples/tutorials/ex2.c $HOME/petsc-handson/ksp
cp $PETSC_DIR/src/ksp/ksp/examples/tutorials/ex2f.F $HOME/petsc-handson/ksp
cp $PETSC_DIR/src/ksp/ksp/examples/tutorials/ex10.c $HOME/petsc-handson/ksp

mkdir -p $HOME/petsc-handson/snes
cp $PETSC_DIR/src/snes/examples/tutorials/makefile $HOME/petsc-handson/snes
cp $PETSC_DIR/src/snes/examples/tutorials/ex19.c $HOME/petsc-handson/snes

## Now compile the examples
cd $HOME/petsc-handson/ksp
make ex2
make ex2f
make ex10
cd $HOME/petsc-handson/snes
make ex19

## Now run various examples

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#ksp #
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## The linear solver example assembles a matrix and solves Ax=b.
cd $HOME/petsc-hanson/ksp

## Run with -help option to list the other command line options
## supported by this example.
mpiexec -n 1 ./ex2 -help

## Print the information about the assembled matrix.
mpiexec -n 1 ./ex2 -mat_view_info

## Print the values in the matrix
mpiexec -n 1 ./ex2 -mat_view

## Graphical view of the assembled matrix.
## **** Note: This requires X11 working between bassi and your desktop. ****
## When a window pops up, you can use the following mouse keys to navigate :
##     - mouse-left : zoom in
##     - mouse-middle: zoom out
##     - mouse-right : continue
mpiexec -n 1 ./ex2 -mat_view_draw -draw_pause -1

## print information regarding the linear solver.
mpiexec -n 1 ./ex2 -ksp_view

## run the same example parallelly - and look at the difference in
## default options for the linear solver.
mpiexec -n 4 ./ex2 -ksp_view

## Load a matrix, vector from a binary file, and solve. Also look at
## the residual at each linear solver iteration.
mpiexec -n 1 ./ex10 -f0 /u2/balay/datafiles/matrices/arco4 -ksp_monitor

## Now run the same problem parallelly - and notice the difference in residuals
mpiexec -n 4 ./ex10 -f0 /u2/balay/datafiles/matrices/arco4 -ksp_monitor

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# pc #
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## Change the default ksp, pc options, and use ILU(4)
mpiexec -n 1 ./ex2 -ksp_type gmres -pc_type ilu -ksp_max_it 9 \
-ksp_compute_eigenvalues -pc_factor_levels 4

## Use ASM preconditioner instead of default bjacobi
mpiexec -n 3 ./ex2 -pc_type asm -sub_pc_type lu -ksp_view

## Use external directsolver package superlu_dist
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## **** Currently petsc build on bassi does hot have this functionality ****

#* mpiexec -n 2 ./ex2 -ksp_type preonly -pc_type lu \
#* -pc_factor_mat_solver_package superlu_dist -ksp_view

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# snes #
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cd $HOME/petsc-handson/snes

## Run a nonlinear example and look at the default solver options.
mpiexec -n 1 ./ex19 -snes_view

## Get the nonlinear convergence history
mpiexec -n 1 ./ex19 -snes_monitor

## Change multi-grid solver options.
mpiexec -n 1 ./ex19 -snes_monitor -nlevels 5 -snes_view
mpiexec -n 1 ./ex19 -snes_monitor -nlevels 5 -snes_view -mg_levels_1_pc_type lu

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# DA  #
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## run with -da_view to look at the parallel partitioning of
## the mesh
mpiexec -n 1 ./ex19 -da_view
mpiexec -n 4 ./ex19 -da_view

# Now check with -da_view_draw
mpiexec -n 1 ./ex19 -da_view_draw -draw_pause -1
mpiexec -n 4 ./ex19 -da_view_draw -draw_pause -1

#####
#profiling#
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## Swith to using optimized version of libraries and recompile ex10.
## Notice PETSC_ARCH is now different.

module add petsc/3.0.0_0
echo $PETSC_ARCH

cd $HOME/petsc-handson/ksp
make ex10

## run with -log_summary to print the performance statistics
mpiexec -n 4 ./ex10 -f0 /u2/balay/datafiles/matrices/arco4 -log_summary

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