

# Assignment #2

HPC Workshop



# Optimization Project

This is an optimization project. We want a faster program.

Select one of the MPI versions of the Stommel programs, `stf_01.f90` or `stc_01.c`, for examples.

(a) Modify it so that the copy in `do_jacobi` from `new_psi` to `psi` is not required. That is eliminate the following lines:

```
##Fortran Version
```

```
psi(i1:i2,j1:j2)=new_psi(i1:i2,j1:j2)
```

```
##C Version:
```

```
for( i=i1;i<=i2;i++)
```

```
    for(j=j1;j<=j2;j++)
```

```
        psi[i][j]=new_psi[i][j];
```

# Optimization Project

(b) Modify the program so that it quits when the solution has converged, instead of continuing for a fixed number of iterations.

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(c) Convert this program to a multigrid type application. We currently start with an initial grid size of  $(N \times N)$  and an initial guess of the solution of the constant 1.0.

We want to start with a smaller grid size say  $(N_1 \times N_1)$  and the initial guess of 1.0.

Run the calculation allowing it to converge.

Then use this solution as an initial guess for a second grid  $(N_2 \times N_2)$  and run to convergence.

Continue this process with increasing grid sizes until you reach your desired size. Typically  $N(n+1) = 2 * N(n)$ .

Do this for a final grid size of  $512 \times 512$  and compare the total number of iterations required and the run times to the original program on the same grid size.

# Extra challenge

