Jacobi Algorithm

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Outline

What I'm gonna do right now

- Give an introduction about Jacobi Algorithm
- The algorithm in the basic sense
- Making stuff parallel
- Demo

Non Parallel version for 2D

```
1  double precision, dimension(0:imax+1,0:kmax+1,0:1) :: phi
2  integer :: t0,t1
3  t0 = 0 ; t1 = 1
4  do it = 1,itmax    ! choose suitable number of sweeps
5    do k = 1,kmax
6      do i = 1,imax
7         ! four flops, one store, four loads
8         phi(i,k,t1) = (  phi(i+1,k,t0) + phi(i-1,k,t0)
9                        + phi(i,k+1,t0) + phi(i,k-1,t0) ) * 0.25
10     enddo
11   enddo
12   ! swap arrays
13   i = t0 ; t0=t1 ; t1=i
14 enddo
```

Non Parallel version for 3D

```
1  double precision, parameter :: osth=1/6.d0
2  do it=1,itmax   ! number of iterations (sweeps)
3    ! not parallelizable right away
4    do k=1,kmax
5      do j=1,jmax
6        do i=1,imax
7          phi(i,j,k) = ( phi(i-1,j,k) + phi(i+1,j,k)
8                       + phi(i,j-1,k) + phi(i,j+1,k)
9                       + phi(i,j,k-1) + phi(i,j,k+1) ) * osth
10       enddo
11     enddo
12   enddo
13 enddo
```

Parallel Version of Jacobi

```
1  !$OMP PARALLEL PRIVATE(k,j,i,jStart,jEnd,threadID)
2    threadID=OMP_GET_THREAD_NUM()
3  !$OMP SINGLE
4    numThreads=OMP_GET_NUM_THREADS()
5  !$OMP END SINGLE
6    jStart=jmax/numThreads*threadID
7    jEnd=jStart+jmax/numThreads ! jmax is amultiple of numThreads
8    do l=1,kmax+numThreads-1
9      k=l-threadID
10     if((k.ge.1).and.(k.le.kmax)) then
11       do j=jStart,jEnd          ! this is the actual parallel loop
12         do i=1,iMax
13           phi(i,j,k) = ( phi(i-1,j,k) + phi(i+1,j,k)
14                        + phi(i,j-1,k) + phi(i,j+1,k)
15                        + phi(i,j,k-1) + phi(i,j,k+1) ) * osth
16         enddo
17       enddo
18     endif
19 !$OMP BARRIER
20   enddo
21 !$OMP END PARALLEL
```

Demo

The End