Simulation and Scientific Computing 2
Seminar

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Red-Black Gauss-Seidel

```
for (int iter = 0; iter < times; iter++){
// red points                        // black points
#pragma omp parallel for             #pragma omp parallel for
for(int j=1;j<height-1;j++){         for(int j=1;j<height-1;j++){
for(int i=1;i<width-1;i+=2){         for(int i=2;i<width-2;i+=2){
 u(i,j)=(1-w)*u(i,j)+                 u(i,j)=(1-w)*u(i,j)+
    w*factor*(f(i,j)+                    w*factor*(f(i,j)+
    h_2_inv*(u(i-1,j)+                   h_2_inv *( u(i-1,j)+
    u(i+1,j)+u(i,j+1)+                   u(i+1,j)+u(i,j+1)+
    u(i,j-1)));}                         u(i,j-1)));}
 j++;                                 j++;
 if(j==height-1)continue;             if(j==height-1)continue;
 for(int i=2;i<width-2 i+=2){         for(int i=1;i<width-1;i+=2){
  if(j==(height-1)*0.5               if(j==(height-1)*0.5
   && i>=(width-1)*0.5)continue;      && i>=(width-1)*0.5)continue;
  u(i,j)=factor*(f(i,j)+              u(i,j)=factor*(f(i,j) +
   h_2_inv*(u(i-1,j)+                   h_2_inv*(u(i-1,j)+
   u(i+1,j)+u(i,j+1)+                   u(i+1,j)+u(i,j+1)+
   u(i,j-1)));                          u(i,j-1)));
}}                                   }}}
```

```
 1 void MGSolver::restrict_2d (...){
 2        // restrict to coarser domain
 3 #pragma omp parallel for schedule(static)
 4   for(int j = 1; j < height-1; j++){
 5   for(int i = 1; i < width-1; i++){
 6     if(j == (height-1)*0.5 && i >= (width-1)*0.5) continue;
 7       int mid_i = 2*i; int mid_j = 2*j;
 8         u_2h(i, j) =
 9           rest.getw1() * u(mid_i - 1, mid_j + 1) +
10           rest.getw1() * u(mid_i     , mid_j + 1) +
11           rest.getw3() * u(mid_i + 1, mid_j + 1) +
12           rest.getw4() * u(mid_i - 1, mid_j     ) +
13           rest.getw5() * u(mid_i     , mid_j     ) +
14           rest.getw6() * u(mid_i + 1, mid_j     ) +
15           rest.getw7() * u(mid_i - 1, mid_j - 1) +
16           rest.getw8() * u(mid_i     , mid_j - 1) +
17           rest.getw9() * u(mid_i + 1, mid_j - 1);
18 }}}
```

David Uhl, Thomas Stadelmayer (FAU)   Short title   June 08/12, 2015   1 / 1

time vs threads