

Exercise Sheet 4

Solution

Lecture Parallel Processing

Winter Term 2024/25

Exercise 1: Parallelization of the Jacobi method using OpenMP (Compulsory Exercise, Weight 2! Submit until Tuesday, December 03rd, 10:00 via moodle)

Exercise 2: Parallelization of the Gauss/Seidel method using OpenMP

Here is a sample parallelization of the solver's k-loop:

```
for (k=0; k<kmax; k++) {  
    #pragma omp parallel private(i, j) firstprivate(a, n)  
    {  
        int ij, ja, je;  
        for (ij=1; ij<2*n-4; ij++) {  
            ja = (ij <= n-2) ? 1 : ij-(n-3);  
            je = (ij <= n-2) ? ij : n-2;  
            #pragma omp for  
            for (j=ja; j<=je; j++) {  
                i = ij-j+1;  
                a[i][j] = 0.25 * (a[i][j-1] + a[i-1][j] +  
                                a[i+1][j] + a[i][j+1]);  
            }  
        }  
    }  
}
```

Exercise 3: Pipelined parallelization of the Gauss/Seidel method using OpenMP (For Motivated Students)

Here is a sample parallelization of the solver's k-loop:

```
#pragma omp for ordered(2) schedule(static, 1)  
for (k=0; k<kmax; k++) {  
    for (i=1; i<n-1; i++) {  
        #pragma omp ordered depend(sink: k, i-1) depend(sink: k-1, i+1)  
        for (j=1; j<n-1; j++) {  
            a[i][j] = 0.25 * (a[i][j-1] + a[i-1][j] +  
                            a[i+1][j] + a[i][j+1]);  
        }  
        #pragma omp ordered depend(source)  
    }  
}
```