Отчет по заданию

«Реализация алгоритма 3D Якоби с использованием графических процессоров»

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1 Постановка задачи

1. Реализовать параллельный алгоритм 3-х мерного Якоби по данному последовательному алгоритму.

2. Оценить ускорение программы по отношению к последовательной версии.

2 Описание программы

При распараллеливании программы было создано 4 ядра:

```
__global__ void function(int mm, int nn, int kk, double* a,
        double* b)
```

Используется для счета алгоритма.

```
__global__ void difference(int mm, int nn, int kk,
        double* a, double* b, double *d)
```

Используется для счета алгоритма.

```
__global__ void ab(int mm, int nn, int kk, double* a, double* b)
```

Используется для счета алгоритма.

```
__global__ void initial(int mm, int nn, int kk, double* a)
```

Параллельно инициализирует массив.

Список функций:

```
double jac_parallel(double* a, int mm, int nn, int kk,
        int itmax, double maxeps)
```

Запускает параллельный счет алгоритма. Возвращает полученное eps.

```
void initial_seq(int mm, int nn, int kk, double *a)
```

Последовательно инициализирует массив.

```
double jac_sequence(double* a, int mm, int nn, int kk,
        int itmax, double maxeps)
```

Запускает последовательный счет алгоритма. Возвращает полученное eps.

```
void print_benchmark(double eps, struct timeval startt,
        struct timeval endt)
```

Выводит результат теста.

3 Результаты работы программы

dim3 block = dim3((L + 7) / 8, (L + 7) / 8, (L + 7) / 8);
dim3 thread = dim3(8, 8, 8);

Последовательное выполнение:

Jacobi3D Benchmark Completed.
Size = 100 x 100 x 100
Iterations = 100
Time in seconds = 0.52
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 384 x 384 x 384
Iterations = 100
Time in seconds = 30.35
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 100
Time in seconds = 66.82
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 200
Time in seconds = 134.47
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Параллельное выполнение:

Jacobi3D Benchmark Completed.
Size = 100 x 100 x 100
Iterations = 100
Time in seconds = 0.06
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 384 x 384 x 384
Iterations = 100
Time in seconds = 1.32
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 100
Time in seconds = 2.52
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 200
Time in seconds = 5.19
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

dim3 block = dim3(64, 64, 64);
dim3 thread = dim3(8, 8, 8);

Последовательное выполнение:

Jacobi3D Benchmark Completed.
Size = 100 x 100 x 100
Iterations = 100
Time in seconds = 0.52
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 384 x 384 x 384
Iterations = 100
Time in seconds = 30.35
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 100
Time in seconds = 66.82
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 200
Time in seconds = 134.47
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Параллельное выполнение:

Jacobi3D Benchmark Completed.
Size = 100 x 100 x 100
Iterations = 100
Time in seconds = 0.20
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 384 x 384 x 384
Iterations = 100
Time in seconds = 1.35
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 100
Time in seconds = 2.53
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

Jacobi3D Benchmark Completed.
Size = 500 x 500 x 500
Iterations = 200
Time in seconds = 5.08
Operation type = floating point
Verification = SUCCESSFUL
END OF Jacobi3D Benchmark

4 Сравнение скорости работы алгоритмов

Последовательный алгоритм:

Теоретическая оценка: $O(L^3 * I)$

Параллельный алгоритм:

Теоретическая оценка: $O(I*???)$