

Теория параллелизма

Отчет

Задание 7

cuBLAS

Выполнил:

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Компилятор: g++

Профилировщик: Nsyght Systems

Замер времени: C++ chrono lib

Результат для матрицы 10x10

Final grid:

10	11.1111	12.2222	13.3333	14.4444	15.5556	16.6667	17.7778	18.8889	20
11.1111	12.2359	13.354	14.4625	15.5626	16.6596	17.7597	18.8682	19.9864	21.1111
12.2222	13.3672	14.4956	15.5999	16.684	17.7604	18.8445	19.9488	21.0773	22.2222
13.3333	14.515	15.6613	16.7575	17.8132	18.8535	19.9091	21.0054	22.1517	23.3333
14.4444	15.6983	16.8769	17.9558	18.9577	19.9312	20.9331	22.012	23.1906	24.4444
15.5556	16.9568	18.1921	19.2312	20.1305	20.9806	21.8799	22.919	24.1543	25.5556
16.6667	18.3812	19.7035	20.6464	21.3526	21.9807	22.6869	23.6298	24.9521	26.6667
17.7778	20.1979	21.5944	22.2984	22.6528	22.9028	23.2572	23.9612	25.3576	27.7778
18.8889	23.0383	24.1776	24.3	24.0572	23.7206	23.4778	23.6002	24.7395	28.8889
20	28.8889	27.7778	26.6667	25.5556	24.4444	23.3333	22.2222	21.1111	30

Результат для матрицы 13x13

Final grid:

10	10.8333	11.6667	12.5	13.3333	14.1667	15	15.8333	16.6667	17.5	18.3333	19.1667	20
10.8333	11.6739	12.5124	13.3476	14.179	15.0071	15.8333	16.6596	17.4877	18.3191	19.1543	19.9928	20.8333
11.6667	12.5163	13.3615	14.199	15.0279	15.8494	16.6667	17.484	18.3055	19.1343	19.9718	20.817	21.6667
12.5	13.3633	14.2183	15.0591	15.8841	16.6958	17.5	18.3042	19.1159	19.9409	20.7817	21.6367	22.5
13.3333	14.2187	15.0893	15.935	16.7537	17.5498	18.3333	19.1169	19.913	20.7316	21.5774	22.4479	23.3333
14.1667	15.089	15.9849	16.8381	17.6457	18.4163	19.1667	19.917	20.6876	21.4952	22.3484	23.2444	24.1667
15	15.9855	16.9233	17.7869	18.5746	19.3032	20	20.6968	21.4254	22.2131	23.0767	24.0145	25
15.8333	16.9299	17.936	18.8115	19.5626	20.2219	20.8333	21.4448	22.104	22.8551	23.7307	24.7368	25.8333
16.6667	17.9646	19.0791	19.9606	20.6425	21.1884	21.6667	22.1449	22.6908	23.3727	24.2542	25.3687	26.6667
17.5	19.1829	20.4554	21.3091	21.8586	22.2224	22.5	22.7776	23.1414	23.6909	24.5446	25.8171	27.5
18.3333	20.8115	22.2504	22.9619	23.2602	23.3428	23.3333	23.3239	23.4065	23.7047	24.4163	25.8552	28.3333
19.1667	23.4794	24.7728	25.0281	24.8775	24.5551	24.1667	23.7783	23.4558	23.3053	23.5605	24.8539	29.1667
20	29.1667	28.3333	27.5	26.6667	25.8333	25	24.1667	23.3333	22.5	21.6667	20.8333	30

Выполнение на CPU

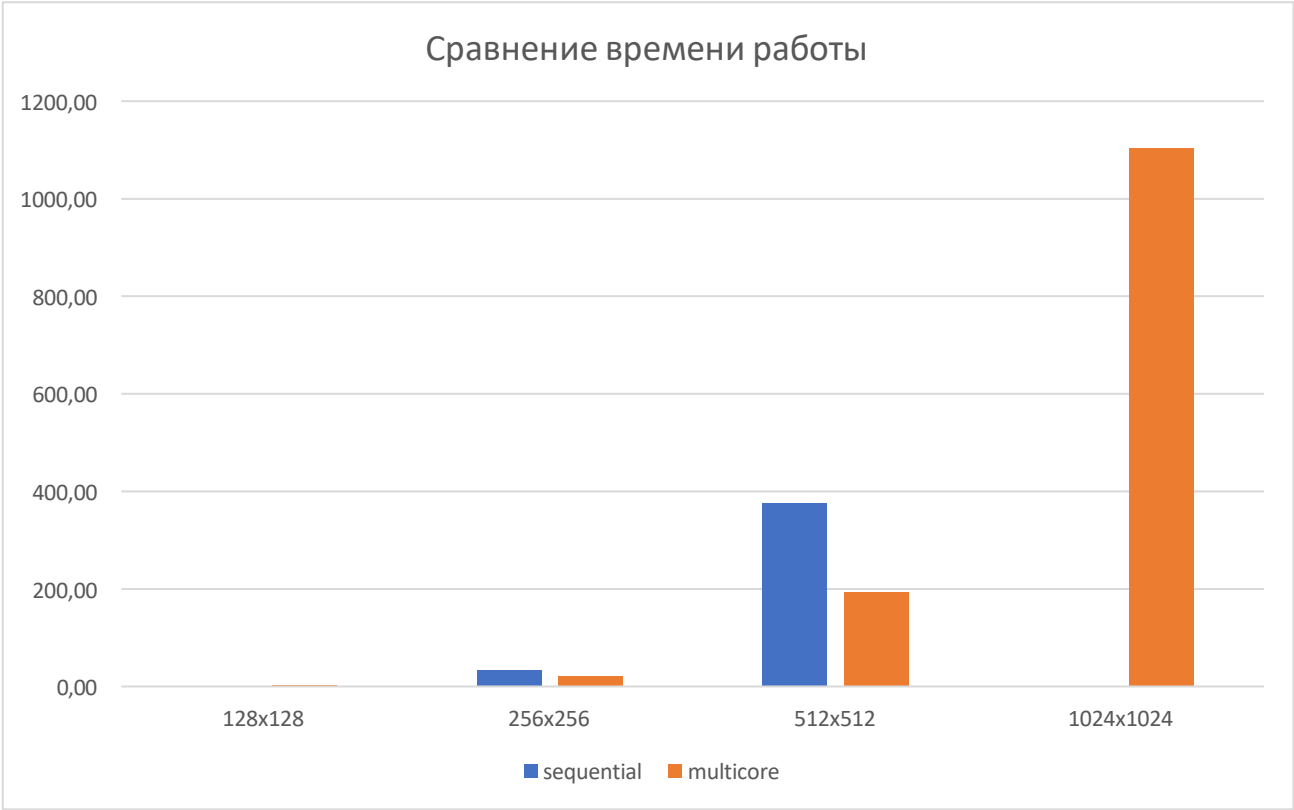
CPU Sequential

Размер сетки	Время	Точность	Кол-во итераций
128x128	1,27	9.99813e-7	43641
256x256	33,10	9.99979e-7	166766
512x512	376,28	9.99997e-7	632912

CPU Multicore

Размер сетки	Время	Точность	Кол-во итераций
128x128	3,58	9.99813e-7	43641
256x256	21,34	9.99979e-7	166766
512x512	194,53	9.99997e-7	632912
1024x1024	1104,84	0,000700391	1000000

Диаграмма сравнения времени выполнения работы



Выполнение на GPU(OpenACC)

Размер сетки	Время	Точность	Кол-во итераций
128x128	4,21	9.99813e-7	43641
256x256	8,62	9.99979e-7	166766
512x512	26,32	9.99997e-7	632912

Результат профилирования

Time (%)	Total Time (ns)	Num Calls	Avg (ns)	Med (ns)	Min (ns)	Max (ns)	StdDev (ns)	Name
11.5	1052415	50	21048.3	20228.5	19584	54420	4842.5	Compute Construct@therm_gpu.cpp:53
11.3	1032924	50	20658.5	19604.0	19202	57836	5680.2	Exit Data@therm_gpu.cpp:53
11.1	1010684	50	20213.7	19491.5	19011	44974	3693.5	Enter Data@therm_gpu.cpp:53
8.3	761995	150	5080.0	6171.0	2315	6986	1946.7	Wait@therm_gpu.cpp:64
8.1	743043	100	7430.4	7335.0	6739	8587	444.2	Wait@therm_gpu.cpp:53
7.7	703604	50	14072.1	13450.0	13144	29359	2859.1	Enqueue Download@therm_gpu.cpp:64
7.6	698431	50	13968.6	13911.5	13489	16391	475.9	Enter Data@therm_gpu.cpp:64
7.6	692593	50	13851.9	13645.0	13096	18557	1017.4	Compute Construct@therm_gpu.cpp:64
5.8	532852	100	5328.5	5181.0	4388	22710	1856.9	Enqueue Launch@therm_gpu.cpp:53
4.5	409298	100	4093.0	4181.5	3306	8080	863.2	Enqueue Upload@therm_gpu.cpp:53
3.2	289864	1	289864.0	289864.0	289864	289864	0.0	Enter Data@therm_gpu.cpp:51
3.1	285566	50	5711.3	5359.0	5062	13176	1343.0	Enqueue Launch@therm_gpu.cpp:64
2.3	211849	50	4237.0	4119.5	3948	6592	419.2	Enqueue Upload@therm_gpu.cpp:64
1.9	174987	1	174987.0	174987.0	174987	174987	0.0	Device Init@therm_gpu.cpp:51
1.6	147573	1	147573.0	147573.0	147573	147573	0.0	Enqueue Upload@therm_gpu.cpp:51
1.6	143719	1	143719.0	143719.0	143719	143719	0.0	Exit Data@therm_gpu.cpp:51
1.5	134310	1	134310.0	134310.0	134310	134310	0.0	Enqueue Download@therm_gpu.cpp:77
1.0	90913	50	1818.3	1801.0	1728	2061	58.9	Exit Data@therm_gpu.cpp:64
0.3	26734	1	26734.0	26734.0	26734	26734	0.0	Wait@therm_gpu.cpp:51
0.0	2767	1	2767.0	2767.0	2767	2767	0.0	Wait@therm_gpu.cpp:77
0.0	0	2	0.0	0.0	0	0	0.0	Alloc@therm_gpu.cpp:51
0.0	0	2	0.0	0.0	0	0	0.0	Alloc@therm_gpu.cpp:53
0.0	0	2	0.0	0.0	0	0	0.0	Create@therm_gpu.cpp:51
0.0	0	100	0.0	0.0	0	0	0.0	Create@therm_gpu.cpp:53
0.0	0	50	0.0	0.0	0	0	0.0	Create@therm_gpu.cpp:64
0.0	0	100	0.0	0.0	0	0	0.0	Delete@therm_gpu.cpp:64
0.0	0	50	0.0	0.0	0	0	0.0	Delete@therm_gpu.cpp:72
0.0	0	2	0.0	0.0	0	0	0.0	Delete@therm_gpu.cpp:77

Выполнение на GPU(cuBLAS)

1) L2-норма

Размер сетки	Время	Точность	Кол-во итераций
128x128	2,25	9.99813e-7	43641
256x256	10,23	9.99979e-7	166766
512x512	39,12	9.99997e-7	632912

Time (%)	Total Time (ns)	Num Calls	Avg (ns)	Med (ns)	Min (ns)	Max (ns)	StdDev (ns)	Name
18.4	1630233	100	16302.3	15873.0	15237	27113	1824.4	Compute Construct@task.cpp:68
17.6	1558787	100	15587.9	14895.0	14208	62745	4946.5	Compute Construct@task.cpp:48
16.0	1417238	100	14172.4	14082.0	13616	17743	532.5	Compute Construct@task.cpp:57
11.7	1036957	100	10369.6	10098.5	9756	21223	1570.3	Wait@task.cpp:68
11.4	1011462	100	10114.6	9954.5	6969	21863	1290.0	Wait@task.cpp:48
10.4	920990	100	9209.9	9158.0	8945	9688	176.6	Wait@task.cpp:57
4.7	419317	100	4193.2	4047.0	3729	8318	681.6	Enqueue Launch@task.cpp:68
4.3	384118	100	3841.2	3478.0	3200	31207	2790.0	Enqueue Launch@task.cpp:48
4.0	356184	100	3561.8	3480.0	3161	6162	449.3	Enqueue Launch@task.cpp:57
1.2	110221	1	110221.0	110221.0	110221	110221	0.0	Device Init@task.cpp:48

2) Максимальная абсолютная ошибка

Размер сетки	Время	Точность	Кол-во итераций
128x128	1,54	9.99813e-7	43641
256x256	5,34	9.99979e-7	166766
512x512	19,19	9.99997e-7	632912

