

Project #2 Numeric Integration with OpenMP Reduction

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Tell what machine you ran this on

M1 MacBook Air

What do you think the actual volume is?

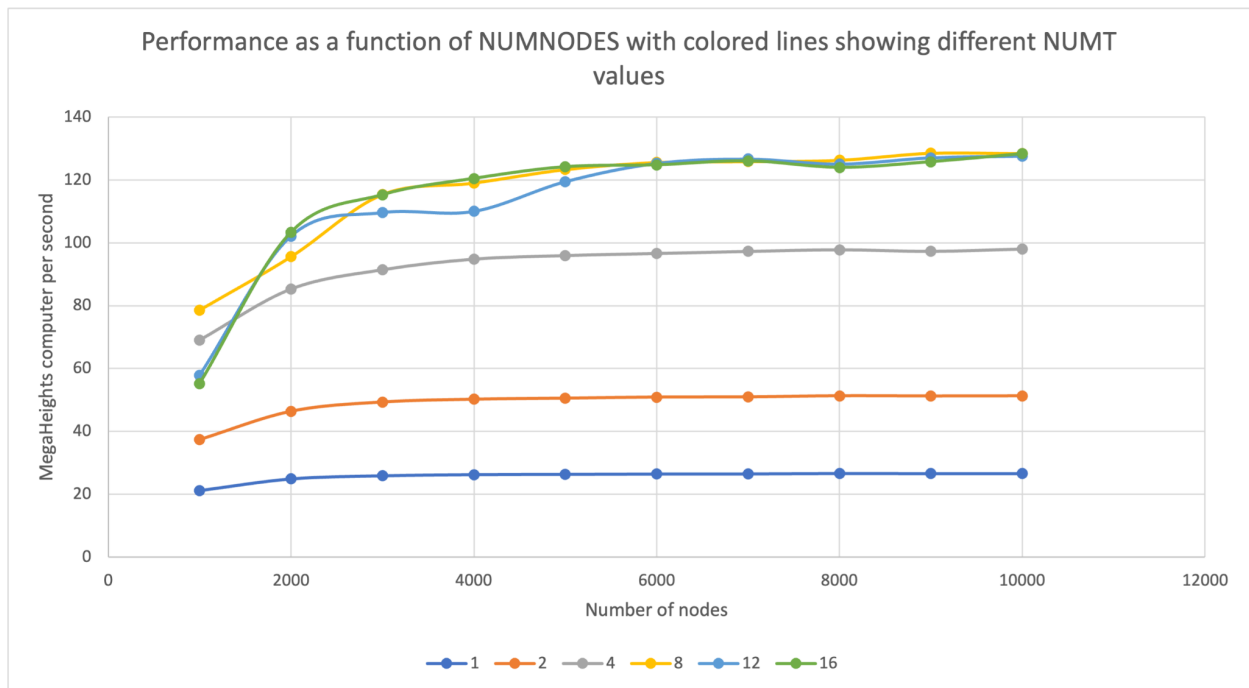
As the number of nodes increases, the approximation gets better. I think the volume is 7.5 units^3 . The volume appears to be approaching a limit of 7.5 units^3

Show the performances you achieved in tables and two graphs

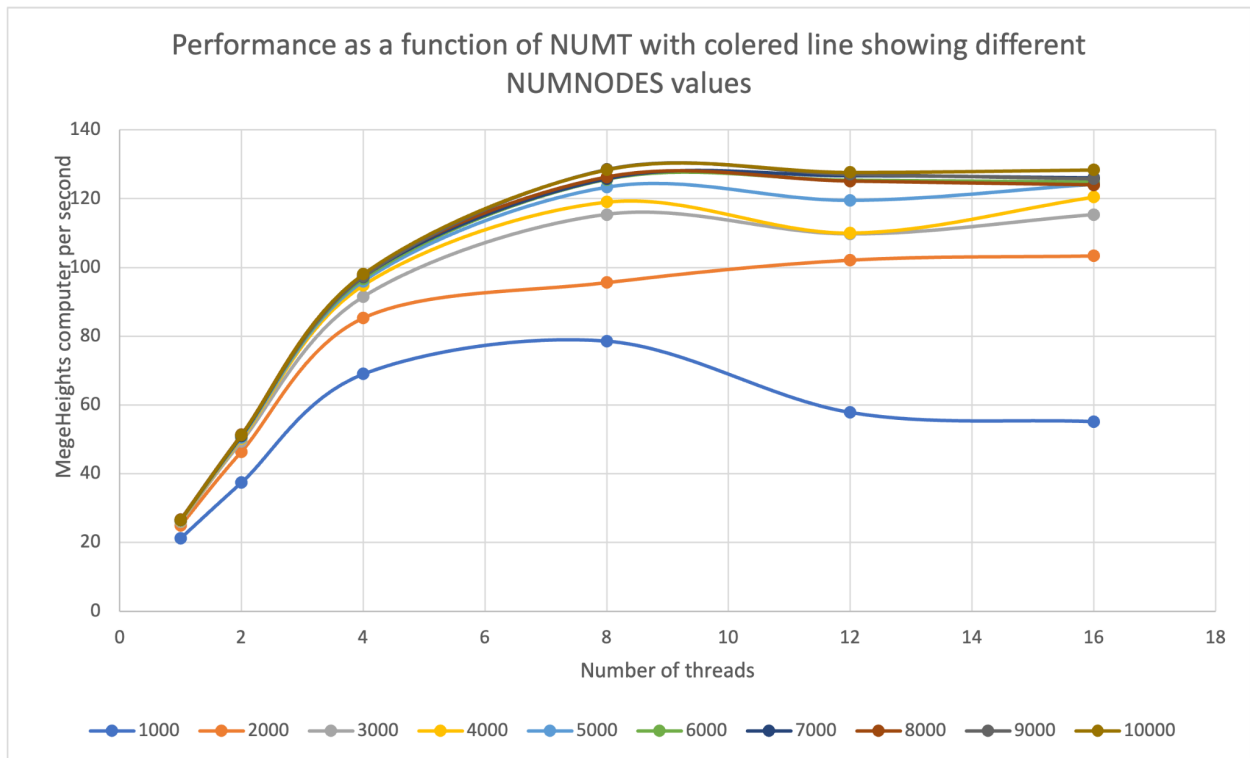
		Number of nodes									
		1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Number of threads	1	21.18	24.89	25.9	26.25	26.36	26.46	26.5	26.63	26.58	26.6
	2	37.41	46.41	49.35	50.23	50.58	50.91	50.99	51.33	51.26	51.31
	4	69	85.28	91.44	94.83	95.97	96.64	97.29	97.82	97.32	98.06
	8	78.62	95.6	115.39	119.05	123.34	125.6	125.86	126.31	128.54	128.41
	12	57.84	102.15	109.67	110.05	119.5	125.32	126.71	125.12	127.11	127.65
	16	55.18	103.37	115.33	120.5	124.21	124.82	126.09	124.02	125.83	128.38

Values are in MegaHeights computer per second

Performance as function of NUMNODES showing different NUMT values



Performance as a function of NUMT showing different NUMNODES values



What patterns are you seeing in the speeds?

Performance starts to plateau at 8 threads. Performance increases with an increasing number of threads.

Why do you think it is behaving this way?

I think my performance starts to plateau at 8 threads because my machine has 8 cores.

What is the Parallel Fraction for this application, using the Inverse Amdahl equation?

Speedup using best performance from 1 and 8 threads – both at 10,000 nodes.

Using F =

$$\frac{n}{(n-1)} \left(1 - \frac{1}{Speedup} \right)$$

Where

- $n = 8$
- $T_1 = 3.789922$ seconds
- $T_8 = 0.655093$ seconds
- $Speedup_8 = T_1/T_8 = 5.785319031038341$

So Parallel fraction $F_p \approx 0.945312783$

Given that Parallel Fraction, what is the maximum speed-up you could ever get?

$$\max Speedup = \lim_{n \rightarrow \infty} Speedup = \frac{1}{F_{sequential}} = \frac{1}{1 - F_{parallel}}$$

$$1/(1-0.945312783) = 18.28580891 \text{ maximum speedup}$$