**CHI CHIEH WENG**

# Numeric Integration

1. **The actual volume:** As the number of threads and nodes increases, the volume of the superquadric converges to approximately 0.44.

| | | **NUMBER OF NODES** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NUMBER OF THREADS** | | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 |
| | 1 | 1.99 | 4.35 | 5.18 | 2.75 | 5.43 | 6.75 | 6.65 | 6.61 |
| | 2 | 2.8 | 3.97 | 3.77 | 4.37 | 6.11 | 11.11 | 13.28 | 13.21 |
| | 4 | 2.69 | 5.1 | 6.21 | 6.88 | 9.1 | 14.99 | 23.1 | 22.84 |
| | 8 | 2.4 | 6.61 | 10.6 | 11.6 | 14.42 | 21.87 | 39.97 | 41.27 |

3. **Performance as a function of NUMNODES with colored lines showing different NUMT values**
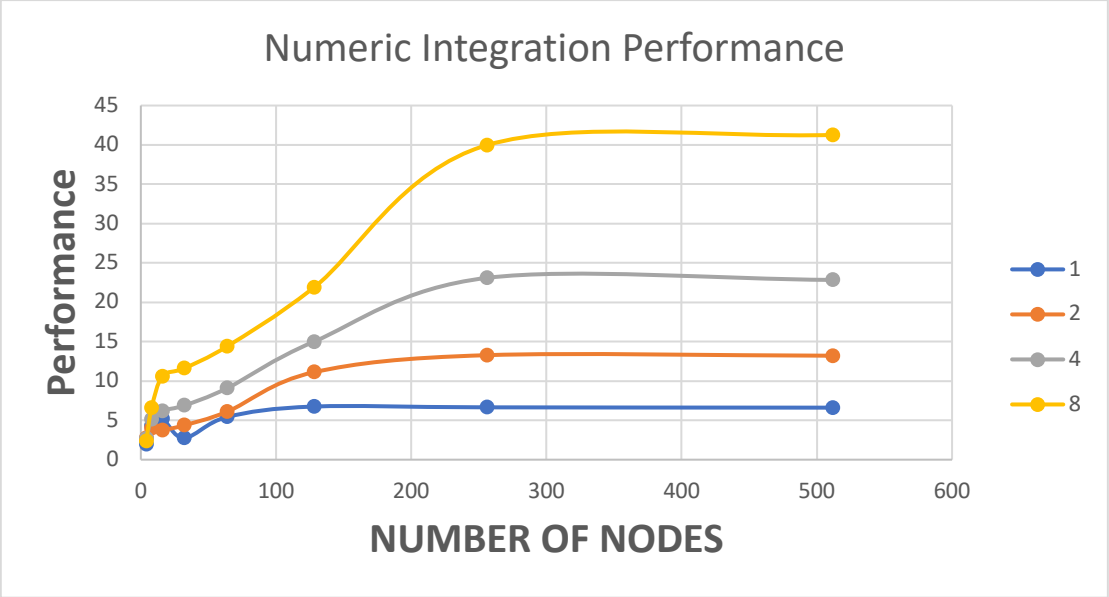


Performance as a function of NUMT with colored lines showing different **NUMNODES values**

**CHI CHIEH WENG**
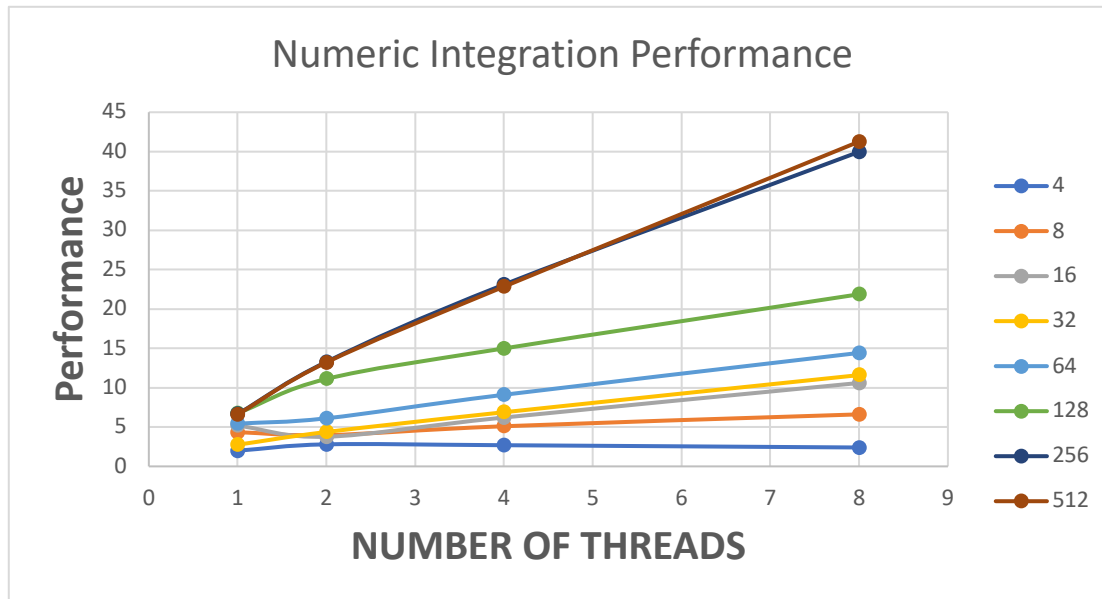


**Speedup (S)** = 41.27/ 6.61= 6.24

(Performance with eight threads, 512 nodes) / (Performance with one thread, 512 nodes )

**Parallel Fraction:** = (8 / (8-1)) * (1 - (1 / 6.24)) = $0.96$

```
os2 ~/575 988$ ./runproj2.csh
 1 threads ;   4 NUMNODES ; maxPerformance =    1.99 ; avgVolume =    0.08
 1 threads ;   8 NUMNODES ; maxPerformance =    4.35 ; avgVolume =    0.36
 1 threads ;  16 NUMNODES ; maxPerformance =    5.18 ; avgVolume =    0.41
 1 threads ;  32 NUMNODES ; maxPerformance =    2.75 ; avgVolume =    0.43
 1 threads ;  64 NUMNODES ; maxPerformance =    5.43 ; avgVolume =    0.43
 1 threads ; 128 NUMNODES ; maxPerformance =    6.75 ; avgVolume =    0.44
 1 threads ; 256 NUMNODES ; maxPerformance =    6.65 ; avgVolume =    0.44
 1 threads ; 512 NUMNODES ; maxPerformance =    6.61 ; avgVolume =    0.44
 2 threads ;   4 NUMNODES ; maxPerformance =    2.80 ; avgVolume =    0.08
 2 threads ;   8 NUMNODES ; maxPerformance =    3.97 ; avgVolume =    0.36
 2 threads ;  16 NUMNODES ; maxPerformance =    3.77 ; avgVolume =    0.41
 2 threads ;  32 NUMNODES ; maxPerformance =    4.37 ; avgVolume =    0.43
 2 threads ;  64 NUMNODES ; maxPerformance =    6.11 ; avgVolume =    0.43
 2 threads ; 128 NUMNODES ; maxPerformance =   11.11 ; avgVolume =    0.44
 2 threads ; 256 NUMNODES ; maxPerformance =   13.28 ; avgVolume =    0.44
 2 threads ; 512 NUMNODES ; maxPerformance =   13.21 ; avgVolume =    0.44
 4 threads ;   4 NUMNODES ; maxPerformance =    2.69 ; avgVolume =    0.08
 4 threads ;   8 NUMNODES ; maxPerformance =    5.10 ; avgVolume =    0.36
 4 threads ;  16 NUMNODES ; maxPerformance =    6.21 ; avgVolume =    0.41
 4 threads ;  32 NUMNODES ; maxPerformance =    6.88 ; avgVolume =    0.43
 4 threads ;  64 NUMNODES ; maxPerformance =    9.10 ; avgVolume =    0.43
 4 threads ; 128 NUMNODES ; maxPerformance =   14.99 ; avgVolume =    0.44
 4 threads ; 256 NUMNODES ; maxPerformance =   23.10 ; avgVolume =    0.44
 4 threads ; 512 NUMNODES ; maxPerformance =   22.84 ; avgVolume =    0.44
 8 threads ;   4 NUMNODES ; maxPerformance =    2.40 ; avgVolume =    0.08
 8 threads ;   8 NUMNODES ; maxPerformance =    6.61 ; avgVolume =    0.36
 8 threads ;  16 NUMNODES ; maxPerformance =   10.60 ; avgVolume =    0.41
 8 threads ;  32 NUMNODES ; maxPerformance =   11.60 ; avgVolume =    0.43
 8 threads ;  64 NUMNODES ; maxPerformance =   14.42 ; avgVolume =    0.43
 8 threads ; 128 NUMNODES ; maxPerformance =   21.87 ; avgVolume =    0.44
 8 threads ; 256 NUMNODES ; maxPerformance =   39.97 ; avgVolume =    0.44
 8 threads ; 512 NUMNODES ; maxPerformance =   41.27 ; avgVolume =    0.44
```

**CHI CHIEH WENG**

**maxSpeedUp** $= 1/(1-0.96) = 25$

Use 8 threads and 512 Nodes.