

CSDL06011 Department Level Optional Course -2 High Performance Computing AY 2023-24 DS and AIML

Module 4 - Performance Measures for HPC (University Numerical on Amdahl's Law)

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Amdahl's Law example

Suppose a serial program reads n data from a file, performs some computation, and then writes n data back out to another file. The I/O time is measured and found to be $4500 + n \mu\text{sec}$. If the computation portion takes $n^2/200 \mu\text{sec}$, what is the maximum speedup we can expect when $n=10,000$ and N processors are used?

Assume that the I/O must be done serially but that the computation can be parallelized. Computing α we find

$$\alpha = \frac{n^2/200}{(4500 + n) + n^2/200} = \frac{500000}{4500 + 10000 + 500000} = \frac{5000}{5145} \approx 0.97182$$

so, by Amdahl's Law,

$$\psi \leq \frac{1}{\left(1 - \frac{5000}{5145}\right) + \frac{5000}{5145N}} = \frac{5145}{145 + 5000/N}$$

This gives a maximum speedup of 6.68 on 8 processors and 11.27 on 16 processors.



Kindly note that Alpha is the fraction of problem can be parallelized.

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