

Exploiting Non-Uniform Utility of Computing: A Case Study

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Abstract : The increasing importance of computing in modern society has brought substantial growth in the demand for more computational power. In some problem domains such as scientific simulations, available computational power still sets a limit on what can be practically explored in computation. For many types of code, there is non-uniformity in the utility of computation. That is not every piece of computation contributes equally to the quality of the result. If this non-uniformity is understood well and exploited effectively, we can much more effectively utilize available computing power. In this paper, we discuss a case study of exploring such non-uniformity in a particle-in-cell simulation platform. We find both the existence of significant non-uniformity and that it is generally straightforward to exploit it. We show the potential of order-of-magnitude effective performance gain while keeping the comparable quality of output. We also discuss some challenges in both the practical application of the idea and evaluation of its impact.

Keywords : approximate computing, landau damping, non uniform utility computing, particle-in-cell

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