Does P-complete have a hierarchy like NP-complete has $W[*]$?

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The area of *Parameterized Complexity* has witnessed tremendous growth in the last two decades and has become a central research area in theoretical computer science. A problem is *fixed-parameter tractable* (FPT) if it has an algorithm that runs in $\mathcal{O}(f(k) \cdot n^{\mathcal{O}(1)})$, where n is the problem size and k is the input parameter that is independent of n, for an arbitrary computable function f. Numerous other NP-complete problems fall into the category of FPT but not all. It has been shown that there is an $W[*]$ hierarchy in NP-complete, and FPT = $W[0]$.

The study of Parameterized Complexity has been extended to parallel computing and this is broadly known as *Parameterized Parallel Complexity*. The first systematic study of Parameterized Parallel Complexity appeared in [2]. A number of problems, unfortunately also not all, do have an NC algorithm after fixed one (or more) nontrivial parameter. For instance, the graph genus problem [3], and the monotone circuit value problem [1]. Actually we already gave a refine class called *fixed-parameter parallel tractable* (FPPT) to characterize the problems that can be efficiently parallelized, which contains all parameterized problems that have a parallel deterministic algorithm with running time $\mathcal{O}(f(k) \cdot (\log n)^{\alpha})$ and using $\mathcal{O}(n^{\beta})$ parallel processors, where n is the problem size, k is the parameter, f is an arbitrary computable function, and α, β are constants independent of n and k.

Then we ask the following question, if restrict our attention to P-complete, does it also have a hierarchy (we call $Z[*]$ temporarily) like $W[*]$ in NP-complete, such that FPPT = $Z[0]$?

References

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