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# ON COMPACT EXPLICIT FORMULAS OF THE PARTIAL FRACTION DECOMPOSITION. APPLICATIONS

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## ABSTRACT

Partial fraction decomposition is a fundamental topic with applications in various fields of mathematic such that calculus, differential equations, control theory, and other fields of applied mathematics and other subject areas. A well known theoretical theorem in algebra asserts that every rational function has unique partial fraction decomposition. Several methods have been improved in the literature for computing the partial fraction decomposition. Despite that, this topic continues to attract much attention, and there have been recent developments in the computation aspect for general rational functions, as well as for some special. Meanwhile, the approaches and methods for decomposing a rational function into partial fractions are computationally intensive, especially when the multiplicities of roots of the denominator are higher.

This talk concerns some new explicit compact formulas of the partial fraction decomposition. We provide an approach for the partial fraction decomposition of the functions $f(x) = R(x)/Q(x)$, where $R(x)$, $Q(x)$ are polynomials in $\mathbb{R}[X]$ or $\mathbb{C}[X]$, which are mutually prime, such that the degree of $r$ is less than the degree of $Q$. The essence of our approach requires a computational process based on some known results. New results are provided and other are recovered. Finally, some applications and illustrative examples are given, in order to show our new approaches.

***K*eywords** Partial fraction decomposition, Compact formulas, Multiple poles,

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