# A new class of root-finding methods in $\mathbb{R}^n$: The Inexact Chebyshev-Halley tensor free class

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**Abstract:** This work introduces a new result about the Chebyshev-Halley Class for solving nonlinear systems. The methods in this class have third-order convergence rate, that means, higher order convergence rate than Newton's method. In contrast, these methods are computationally expensive, requiring second-order derivatives. The result presented here is the introduction of a new class of methods, called Inexact Chebyshev-Halley tensor free Class, by not computing the second derivative tensor and by approximately solving two linear systems required for obtaining the necessary intermediate computations. Besides presenting the proof of convergence, we show that, depending on the assumptions, the methods of this class can have superlinear, quadratic, superquadratic or cubic convergence rates. We also show that these assumptions are quite reasonable. Finally, numerical evidence that shows significant improvement when using the inexact tensor free strategy (in the context of the classical methods of Chebyshev-Halley class) proposed in this work, is presented.

**Keywords:** Chebyshev-Halley Class, tensor free.

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