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Complex-step derivative approximation in noisy environment

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Abstract

The complex-step derivative approximation is a powerful method for derivative approximations which has been successfully implemented in deterministic numerical algorithms. We explore and analyze its implementation in noisy environment through examples, error analysis and application to optimization methods. Numerical results show a promising performance of the complex-step gradient approximation in noisy environment.

Key words. derivative approximation, complex-step derivative approximation, nonmonotone line-search methods, noisy environment.
AMS subject classification. 65D25, 30E10, 90C56

1 Introduction

Approximations of derivatives of functions are widely used in many areas such as chemical, biomedical and mechanical engineering, physics and finance, in solving differential equations or optimization. It might happen that there exists an underlying function which should be differentiated, but only its values at a sampled data set are known, without knowing the function itself;

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