

# Evaluating the Fréchet derivative of the matrix $p$ th root

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## Abstract

The sensitivity of the matrix  $p$ th root (and primary matrix functions in general) to small perturbations in the data can be measured by a condition number based on the norm of the Fréchet derivative. In this talk we show that computing the Fréchet derivative of the matrix  $p$ th root is equivalent to solve a sequence of  $p$  Sylvester equations. This provides the theoretical support to design an algorithm for the effective computation of the Fréchet derivative. Some numerical experiments will be carried out to illustrate the results and basic facts about matrix  $p$ th roots, Fréchet derivatives, Kronecker products and Sylvester equations will be revisited.

## Keywords

Conditioning, Matrix  $p$ th root, Sylvester equation, Fréchet derivative, Kronecker products.