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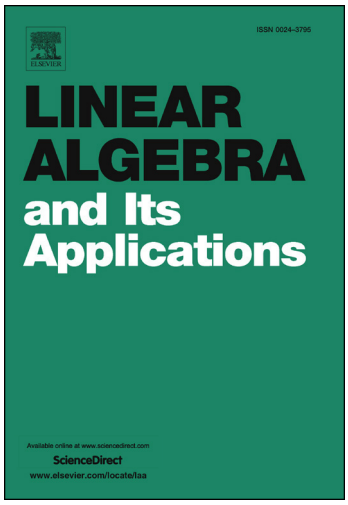

Efficient evaluation of matrix polynomials

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PII: S0024-3795(17)30638-9
DOI: https://doi.org/10.1016/j.laa.2017.11.010
Reference: LAA 14377

To appear in: *Linear Algebra and its Applications*

Received date: 31 October 2016
Accepted date: 9 November 2017

Please cite this article in press as: J. Sastre, Efficient evaluation of matrix polynomials, *Linear Algebra Appl.* (2018), https://doi.org/10.1016/j.laa.2017.11.010

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Efficient evaluation of matrix polynomials

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Abstract

This paper presents a new family of methods for evaluating matrix polynomials more efficiently than the state-of-the-art Paterson–Stockmeyer method. Examples of the application of the methods to the Taylor polynomial approximation of matrix functions like the matrix exponential and matrix cosine are given. Their efficiency is compared with that of the best existing evaluation schemes for general polynomial and rational approximations, and also with a recent method based on mixed rational and polynomial approximants. For many years, the Paterson–Stockmeyer method has been considered the most efficient general method for the evaluation of matrix polynomials. In this paper we show that this statement is no longer true. Moreover, for many years rational approximations have been considered more efficient than polynomial approximations, although recently it has been shown that often this is not the case in the computation of the matrix exponential and matrix cosine. In this paper we show that in fact polynomial approximations provide a higher order of approximation than the state-of-the-art computational methods for rational approximations for the same cost in terms of matrix products.

Keywords: matrix, polynomial, rational, mixed rational and polynomial, approximation, computation, matrix function.
PACS: 87.64.Aa

1. Introduction

In this paper we propose a new family of methods for evaluating matrix polynomials more efficiently than the state-of-the-art Paterson–Stockmeyer method combined with Horner's method [1], [2, Sec. 4.2]. The proposed

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