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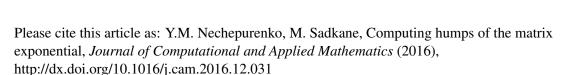
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## **ACCEPTED MANUSCRIPT**

## Computing humps of the matrix exponential

Yu.M. Nechepurenko $^{\rm a,1}$ , M. Sadkane $^{\rm b,*}$ 

#### Abstract

This work is devoted to finding maxima of the function  $\Gamma(t) = \|\exp(tA)\|_2$  where  $t \geq 0$  and A is a large sparse matrix whose eigenvalues have negative real parts but whose numerical range includes points with positive real parts. Four methods for computing  $\Gamma(t)$  are considered which all use a special Lanczos method applied to the matrix  $\exp(tA^*)\exp(tA)$  and exploit the sparseness of A through matrix-vector products. In any of these methods the function  $\Gamma(t)$  is computed at points of a given coarse grid to localize its maxima, and then maximized by a standard maximization procedure or via an alternating maximization procedure. Results of such computations with some test matrices are reported and analyzed.

 $Key\ words:$  matrix exponential norm, time integration method, Krylov subspace method, truncated Taylor series method, Lanczos method, alternating maximization

#### 1. Introduction

This paper is concerned with the computation of maxima of the function

$$\Gamma(t) = \|\exp(tA)\|_2 \tag{1}$$

in a given nonnegative interval of time t, where A is an  $n \times n$  matrix with negative spectral abscissa, i.e., the largest real part of eigenvalues of A, denoted by  $\alpha(A)$ , is

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