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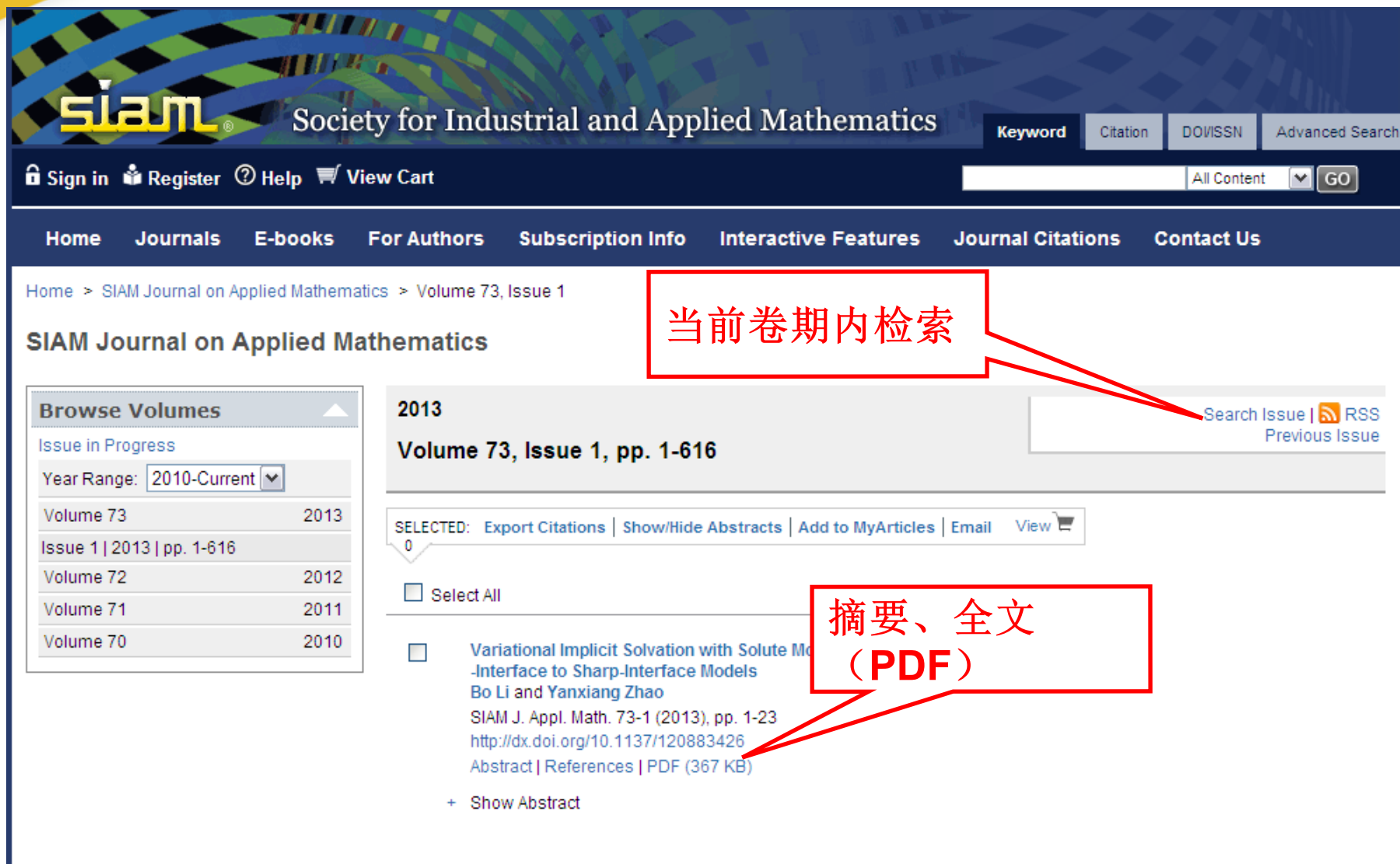
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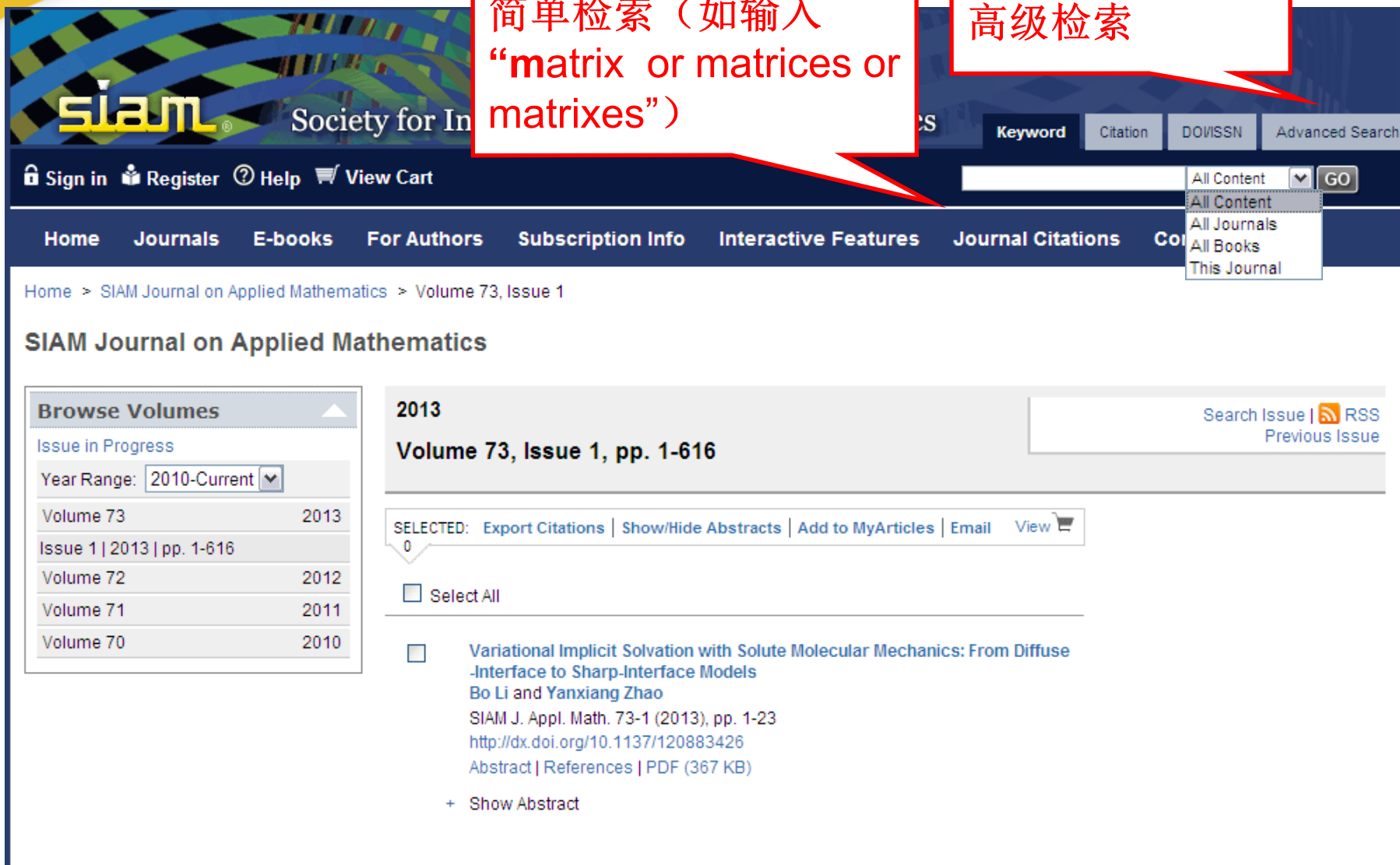
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On the Use of Discrete Laplace Operator for Preconditioning Kernel Matrices

摘要

Jie Chen

This paper presents a preconditioning strategy applied to certain types of kernel matrices that are increasingly ill-conditioned. The ill-conditioning of these matrices is tied to the unbounded variation of the Fourier transform of the kernel function. Hence, the basic idea is to differentiate the kernel in order to suppress the variation. The idea resembles some preconditioning methods for Toeplitz matrices, where the theory heavily relies on a fixed generating function. The theory does not apply to the case of a fixed kernel with increasingly fine discretizations because the generating function depends on the size. For this case, we prove equal distribution results on the spectrum of the resulting matrices. Furthermore, the proposed preconditioning technique also applies to non-Toeplitz matrices, thus eliminating the reliance on a regular grid structure of the points. The preconditioning strategy can be used to accelerate an iterative solver for solving linear systems with respect to kernel matrices.

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History

Submitted: 23 April 2012
Accepted: 07 December 2012
Published online: 05 March 2013

Keywords

Laplace operator, preconditioning, kernel matrix, Toeplitz matrix, stiffness matrix

AMS Subject Headings

65F08, 65C60

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