

Golub, Gene H.; Milanfar, Peyman; Varah, James

A stable numerical method for inverting shape from moments. (English) Zbl 0956.65030
SIAM J. Sci. Comput. 21, No. 4, 1222-1243 (1999).

The reconstruction of a polygon in the complex plane from its moments is studied. The paper presents a stable method. In its outline (a Hankel-matrix generalized eigenvalue problem), the key points are the clarification of the sensitivity (with numerical illustrations) and improved conditioning (via shifts of moments and their diagonal scaling). Motivation is beyond any doubt: Similar problems are currently very ill conditioned though often needed in practice. In order to underline that, an explicit application is offered at the end (in a geophysical reconstruction of an anomalous domain from its gravimetric measurements) and several others are listed (notably: tomography).

In a historical comment a duality of the problem in question to a 2-D numerical quadrature (in a way generalizing the Motzkin and Schoenberg formula for triangular regions) is pointed out, and a remark is added recalling its connection (and a broader grasp in comparison) with the matrix pencil solution of certain signal decomposition problems.

Reviewer: [Miloslav Znojil \(Řež\)](#)

MSC:

- [65F15](#) Numerical computation of eigenvalues and eigenvectors of matrices
- [44A60](#) Moment problems
- [65F35](#) Numerical computation of matrix norms, conditioning, scaling
- [65E05](#) General theory of numerical methods in complex analysis (potential theory, etc.)
- [94A12](#) Signal theory (characterization, reconstruction, filtering, etc.)
- [86A20](#) Potentials, prospecting

Cited in **1** Review
Cited in **39** Documents

Keywords:

[inverting shape from moments](#); [Hankel-matrix generalized eigenvalue problem](#); [conditioning](#); [geophysical reconstruction](#); [scaling](#); [gravimetric measurements](#); [matrix pencil solution](#); [signal decomposition problems](#)

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