Summary: In frequency analysis an often appearing problem is the reconstruction of a signal from given samples. Since the samples are usually noised, pure interpolating approaches are not recommended and appropriate approximation methods are more suitable as they can be interpreted as a kind of denoising. Two approaches are widely used. One uses the reflection coefficients of a finite sequence of Szegő polynomials and the other one the zeros of the so called Prony polynomial. We show that both approaches are closely related. As a kind of inverse problem, it’s not surprising that they have in common that both methods depend very sensitive on sampling errors. We use known properties of the signal to estimate the positions of the zeros of the corresponding Szegő- or Prony-like polynomials and construct adaptive algorithms to calculate these ones. Hereby, we get the corresponding parameters in the exponential parts of the signal, too. Then, the coefficients of the signal (as a linear combination of such exponential functions) can be obtained from a system of linear equations by minimizing the residuals with respect to a suitable norm as a kind of denoising.

MSC:
- 65F15 Numerical computation of eigenvalues and eigenvectors of matrices
- 65H04 Numerical computation of roots of polynomial equations
- 94A12 Signal theory (characterization, reconstruction, filtering, etc.)

Keywords:
- prony’s method
- prony polynomial
- Szegő polynomial
- exponential sum
- Hessenberg matrix
- recurrence relation
- Chebyshev polynomial
- overdetermined system
- recovery of structured functions

Full Text: DOI

References:


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