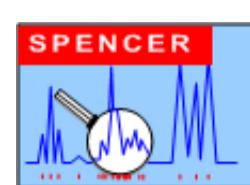


Subband Parameter Estimation of Noisy Complex Exponential data Records

E.-H. Djermoune et M. Tomczak



SPENCER : Nuclear magnetic resonance spectroscopy signal analysis software

Problem Formulation

- Model : complex signal containing K damped exponentials

$$x(n) = \sum_{k=1}^K A_k e^{j\phi_k} e^{(\alpha_k + j\omega_k)n} + e(n) := \sum_{k=1}^K a_k z_k n + e(n)$$

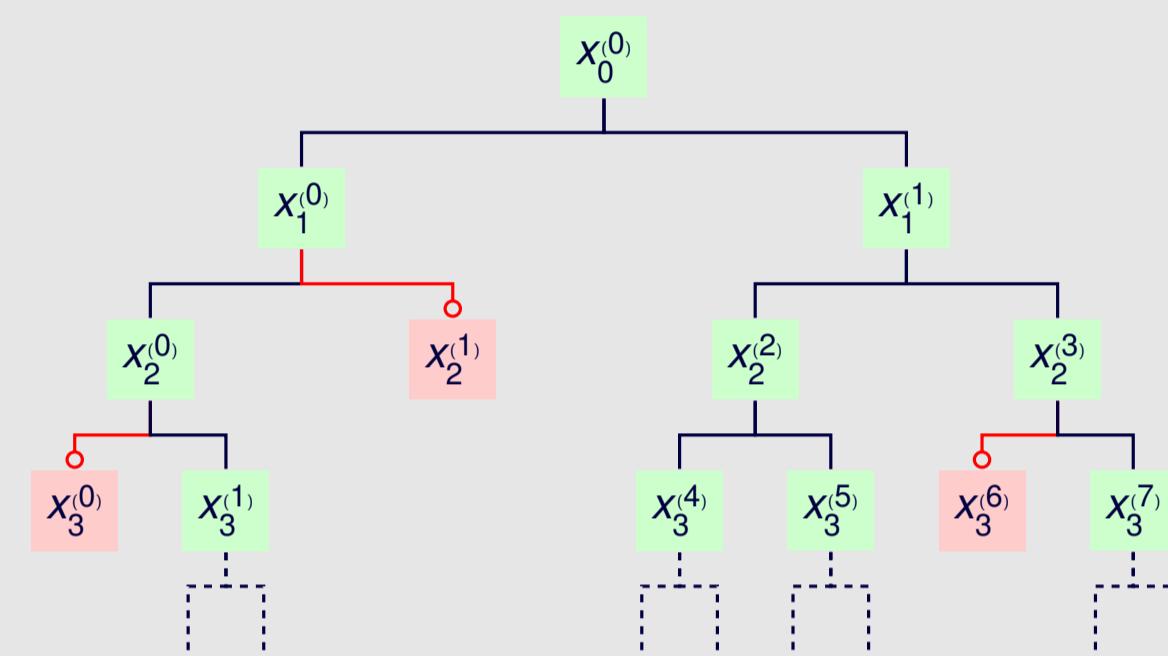
- Problem : estimate parameters K et $\{z_k, a_k\}_{k=1}^K$
- Method : adaptive subband decomposition

High-Resolution Methods

- Linear prediction and SVD [Kumaresan et al. 1982]
- Matrix Pencil [Hua et al. 1990]
- Direct data approximation [Kung et al. 1983]
- High-order Yule-Walker and SVD [Tomczak et al. 2002]

Subband Decomposition

- Complexity reduction : adaptive subband decomposition
- Stopping rule : spectral flatness of residuals



Description

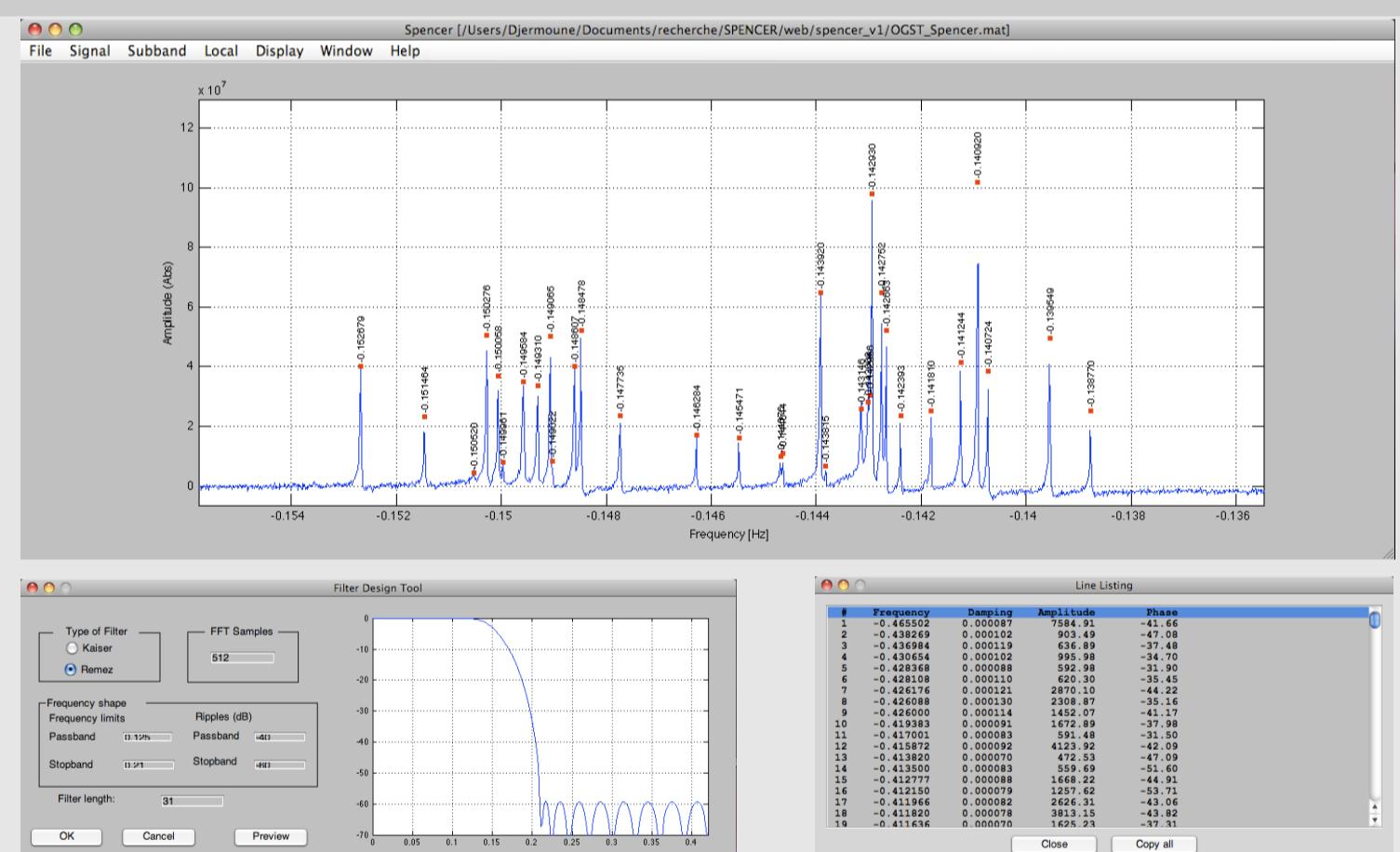
Open software written in Matlab® (GUI)

Features

- Data import/export : Bruker, Excel
- Phase correction et baseline suppression
- Decimation filter design
- Includes adaptive and uniform subband decomposition
- Includes several estimation methods
- Line listing, graphical representations, etc.

Download

<http://w3.cran.univ-lorraine.fr/el-hadi.djermoune/?q=content/spencer>



Example : C-13 NMR Spectroscopy

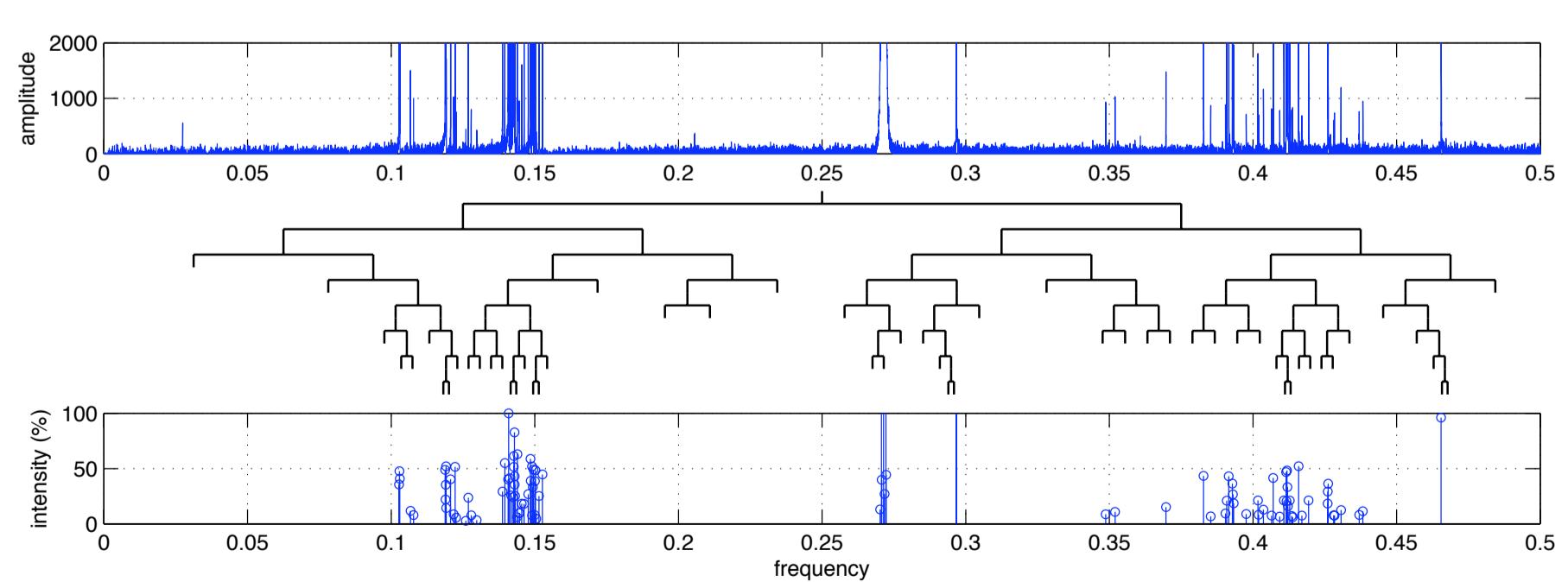
Data

- Mixture of 19 compounds in CDCl_3
- Sample size : 128k
- Number of spectral lines : $K = 104$

Results

Decomposition	Lines	Subbands
SPENCER	93	55
MDL-based	90	72
Uniform	90	256

Decomposition tree and Detected lines



<http://www.cran.univ-lorraine.fr>