

Dear editors,

we would like to submit our study on a novel signal decomposition technique, which can be seen as an additional source of information for frequency analysis. Fourier analysis can yield unintuitive results (and interpretations) when the signal under study is of spiky nature. Our proposed method bridges this gap by using spike-trains with different inter spike periods as basis functions for the decomposition. Together with a sparse regression technique this method resolves recurring sharp peaks in the signal under study.

We combine this approach with recurrence probabilities (which often have a spiky appearance) obtained from recurrence plots in order to get an idea of higher-dimensional frequency domains of exemplary systems. Especially in combination and comparison to Fourier spectra this approach seems to be promising. In view of the wide application of frequency analysis in myriad scientific fields and in the commercial environment, we believe that this study could make an important contribution to better understand complicated and spiky signals. To prove the concept, we have analyzed here not only well-known theoretical models from different scientific fields (nonlinear dynamics, earth orbit states), but also real data from power grids.

We confirm that neither the manuscript nor any parts of its content are currently under consideration or published in another journal.

All authors have approved the manuscript and agree with its submission to Entropy.

Sincerely,
K. Hauke Kraemer