Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A Time-Spectral Analysis for Summed Linear and Product Signals with Applications to Fluid Mechanics and Chaotic Systems[1] CHIEN C. CHANG, Guangxi University and National Taiwan University, SHENG-SHENG LU, YEN-LIANG LEE, Guangxi University, JEN-JEN LIN, Ming-Chuan University — There are time signals of general interest put in the form: Time signal = trend with time + periodic components + residual or randomness. It is of great importance to identify the periodic components whose frequencies and amplitudes may be varying with time. In the past, we have seen excellent works on time-frequency analysis of a signal such as short-time Fourier, wavelet, Hilbert-Huang transforms among others. Yet there are still critical and fundamental issues to be addressed. Notably all the previous analysis (tacitly) assumes that the signal concerned is a linear superposition of its decomposed components no matter whether a base set of functions or no base is employed. Moreover, a common query is that the signal may often be over-decomposed that the analysis with respect to individual modes does not catch the essential features of the signals spectral content. In this study, we propose to develop a principal frequency analysis suitable for general summed linear signals and product signals (beats/wave-packets). As an illustration, this approach of analysis is first applied to several basic examples and then to time-dependent drag in fluid mechanics and signals of a chaotic Rosseler system.

[1]This work was supported by NNSF (China, 11672077) and MOST (Taiwan, 105-2221-E-002 -105 -MY3).

Chien C. Chang
Guangxi University and National Taiwan University

Date submitted: 29 Jul 2019 Electronic form version 1.4