

## **Research Highlight: Recursive diffeomorphism-based regression for shape functions**

### **Work of Assistant Professor YANG Haizhao**

This paper proposes a recursive diffeomorphism based regression method for extracting nonlinear and nonstationary dynamics from their superposition. First, a synchrosqueezed transform is applied to estimate instantaneous information of these dynamical systems without their interference. Second, a novel approach based on diffeomorphisms and nonparametric regression is proposed to estimate the waveforms of these dynamical systems. These two methods lead to a complete framework for the empirical mode decomposition problem, a challenging example of single-channel source separation problem, with wide applications in science and engineering including but not limited to medicine (like ECG and EEG readings), physical science (e.g., gravitational waves, atomic crystal images), mechanical engineering (such as vibration measurements), finance, geology (e.g., seismic data analysis), art investigation, and audio signals (including speech and music recordings).

#### **Reference:**

J.R. Xu, **H.Z. Yang**, I. Daubechies, "Recursive diffeomorphism-based regression for shape functions". *SIAM Journal on Mathematical Analysis*, 50, No. 1 (2018): 5-32.