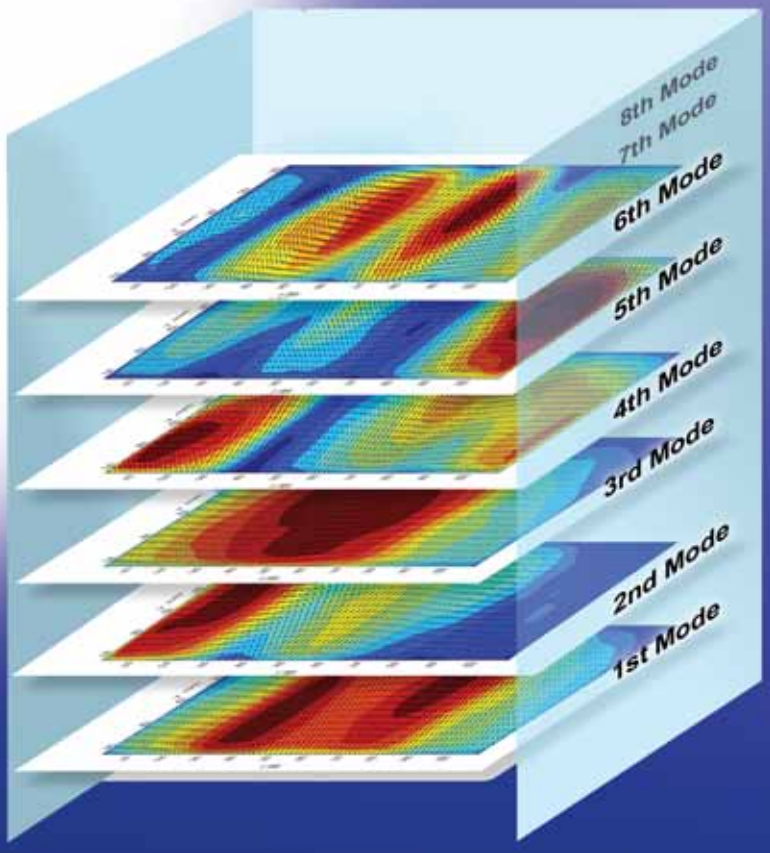
Proper Orthogonal Decomposition (POD)

With POD, Extract More Flow Information

- *Identification of coherent and energetic events*
- *Spatial and temporal characterization of the flow*
- *Spatial characteristics of the flow field using the respective POD modes*
- *Properties of the reconstructed flow-from velocity and vorticity fields to advanced statistical property fields*



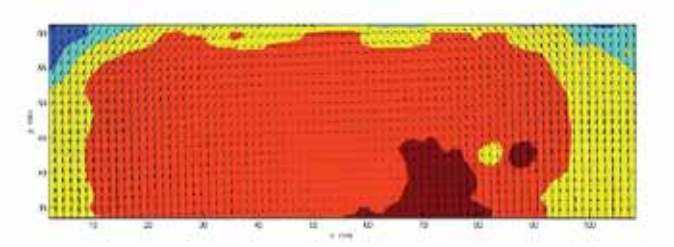
TSI®

Proper Orthogonal Decomposition (POD)

Proper Orthogonal Decomposition was introduced to the fluid mechanics community over 30 years ago. It is also known as Principal Component Analysis and Karhunen-Loeve Decomposition in fields such as computer vision and pattern recognition. POD is a robust, unambiguous technique used for recognizing or identifying key dominant features in data sets. In fluid mechanics, POD has gained recognition as a powerful tool for examining turbulence and understanding the underlying mechanisms. When applied to flows, this technique has the ability to identify structures that contribute most to the energy of the flow. The decomposition of the flow by this technique provides a set of modes that represent flow structures containing most of the energy. Thus, POD has gained a wide spread reputation for identifying dominant or coherent features in a flow.

POD For Experimental Fluid Mechanics

PIV measurements provide instantaneous velocity fields with high spatial resolution over a period of time. This type of large data set is ideally suited for POD analysis. The analysis of the fields provides a powerful tool for identifying dominant structures and events in the flow.

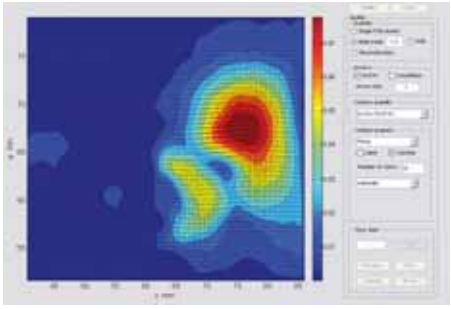


POD is a very useful tool for:

- Identifying coherent structures and energetic events in the flow
- Extracting useful information about the physical process from a large set of data
- Extracting dominant structures and hidden events in the random or incoherent turbulent motion
- Reconstructing the flow field using the minimum number of modes that account for the most amount of energy

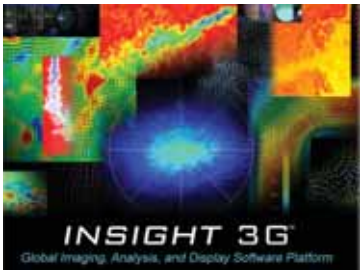
Two methods for calculating the POD modes are the *Direct method* and the *Snapshots method*, both of which are incorporated into the software. The selection of which method to use depends upon the size of the input data matrix. The contribution of the different modes to the total energy can be graphically displayed. This provides the relative energy level as a function of the number of POD modes. All these are provided as user selectable functions. Detailed displays from the analysis are provided as part of the package.

POD is one of the analysis tools now available in the ***INSIGHT 3G*** *software package.*



INSIGHT 3G™ Global Imaging, Analysis, and Display Software Platform

The ***INSIGHT 3G*** package features all of the tools needed for even the most advanced global imaging measurements, from our patented processing algorithms to the most elaborate data analysis features available. And now, equipped with the *HyperStreaming* Module, the power of the ***INSIGHT 3G*** Platform can be unleashed on enormous amounts of data, using features such as the POD Analysis Toolbox and distributed processing capability over a network of computers to quantify the flow properties of interest with the desired detail.



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