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## Real-time 3D Image Processing Platform for Visualizing Blood Flow Dynamics

Tech ID: 30157 / UC Case 2015-326-0

### BRIEF DESCRIPTION

Researchers at UCI have developed an image processing platform capable of visualizing 3D blood flow dynamics of the heart in real-time. This technology aims to be a promising tool for looking at areas of the heart that were previously difficult to image and to better understand the dynamics in cardiac dysfunctions.

### SUGGESTED USES

- Visualize blood flow dynamics of the heart in a real-time
- Aid in diagnosis, decision making and treatment with regard to cardiac functions and dysfunctions
- Validate other 3D particle tracking methods previously developed for similar purposes Visualize flow underwater

### FEATURES/BENEFITS

- Uses 3D ultrasound or sonar imaging devices to acquire images
- Can interpret flow dynamics by tracking particle brightness with and without contrast agents
- Provides software capable of processing and analyzing images so flow and boundaries of structures can be visualized
- Provides software for validating other 3D particle tracking techniques

Universal features of software provide image processing of other types of flows

### TECHNOLOGY DESCRIPTION

Echo Particle Image Velocimetry (PIV) is a non-invasive ultrasonic technique used to image blood flow in patients. Currently, 2D blood flow information obtained by echocardiography is widely used to diagnose cardiac dysfunction. While this 2D echocardiography method is useful, it does not provide sufficient accuracy for characterizing complex 3D and volumetric flows in the heart. For example, it is difficult to accurately image flow patterns in the right heart or hearts of patients with congenital defects or quantify mitral regurgitation. Some 3D PIV techniques have been developed, however, these methods are dependent on experimental parameters, making it difficult to compare results and validate the current methods.

Researchers at the UCI have developed a new PIV method that acquires blood flow in three spatial dimensions and in real-time. This method takes sequential images and tracks particles in the medium using inherent brightness such as blood's natural speckles or with brightness from IV contrast. Images of the heart chambers are obtained from a 3D ultrasound device and are processed and analyzed to provide visualization of the flow dynamics. Two types of Echo-PIV methods are utilized: 1) multi-planar reconstruction which achieves better temporal resolution compared to spatial resolution and 2) direct volumetric acquisition which achieves better spatial resolution compared to temporal resolution. The most suitable method is chosen

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### INVENTORS

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### OTHER INFORMATION

### CATEGORIZED AS

- » **Imaging**
  - » 3D/Immersive
  - » Medical
  - » Software
- » **Medical**
  - » Imaging

### RELATED CASES

2015-326-0

based on acquisition parameters and spatial and temporal resolution of the images. Furthermore, this new technology includes software that provides a framework for validating other 3D PIV methods.

Overall, the unique functions of this 3D platform allow for real-time study of different areas of the heart, better characterization of flow patterns in damaged chambers or valves, and ultimately more effective diagnosis of potential cardiac problems. Additionally, the universal features of this technology allow it to be applied to other flowing mediums such as flow underwater where images are acquired through sonar imaging devices.

## STATE OF DEVELOPMENT

This imaging method has been tested in a pulsatile heart-flow simulator. It is now being tested in clinics.

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,962,142	05/08/2018	2015-326

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Percutaneous Heart Valve Delivery System Enabling Implanted Prosthetic Valve Fracture
- ▶ A distensible wire mesh for a cardiac sleeve
- ▶ Method to Improve the Accuracy of an Independently Acquired Flow Velocity Field Within a Chamber, Such as a Heart Chamber
- ▶ Percutaneous Heart Valve Delivery System
- ▶ Growth-Accommodating Transcatheter Pulmonary Valve System
- ▶ System for Transcatheter Grabbing and Securing the Native Mitral Valve's Leaflet to a Prosthesis
- ▶ Method for Synchronizing a Pulsatile Cardiac Assist Device with the Heart
- ▶ Automated Histological Image Processing tool for Identifying and Quantifying Tissue Calcification
- ▶ Fully Automated Multi-Organ Segmentation From Medical Imaging
- ▶ Simple, User-friendly Irrigator Device for Cleaning the Upper Aerodigestive Tract and Neighboring Areas
- ▶ Automated 3D Reconstruction of the Cardiac Chambers From MRI or Ultrasound
- ▶ Minimally Invasive Percutaneous Delivery System for a Whole-Heart Assist Device

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