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Three Dimensional Energetics of Left Ventricle Flows Using Time-Resolved DPIV OLGA PIERRAKOS, PAVLOS VLACHOS, Dept. of Mechanical Engineering, Virginia Tech, COMPLEX THERMO-FLUID SYSTEMS LABORATORY TEAM — Left ventricular (LV) flows in the human heart are very complex and in the presence of unhealthy or prosthetic heart valves (HV), the complexity of the flow is further increased. Yet to date, no study has documented the complex 3D hemodynamic characteristics and energetics of LV flows. We present high sampling frequency Time Resolved DPIV results obtained in a flexible, transparent LV documenting the evolution of eddies and turbulence. The purpose is to characterize the energetics of the LV flow field in the presence of four orientations of the most commonly implanted mechanical bileaflet HV and a porcine valve. By decomposing the energy scales of the flow field, the ultimate goal is to quantify the total energy losses associated with vortex ring formation and turbulence dissipation. The energies associated to vortex ring formation give a measure of the energy trapped within the structure while estimations of the turbulence dissipation rate (TDR) give a measure of the energy dissipated at the smaller scales. For the first time in cardiovascular applications, an LES-based PIV method, which overcomes the limitations of conventional TDR estimation methods that assume homogeneous isotropic turbulence, was employed. We observed that energy lost at the larger scales (vortex ring) is much higher than the energy lost at the smaller scales due to turbulence dissipation.

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