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**Color Doppler Ultrasound Velocimetry Flow Reconstruction using Vorticity-Streamfunction Formulation** BRETT MEYERS, PAVLOS VLACHOS, CRAIG GOERGEN, CARLO SCALO, Purdue University — Clinicians commonly utilize Color Doppler imaging to qualitatively assess the velocity in patient cardiac or arterial flows. However Color Doppler velocity are restricted to two-dimensional one-component measurements. Recently new methods have been proposed to reconstruct a two-component velocity field from such data. Vector Flow Mapping (VFM), in particular, utilizes the conservation of mass to reconstruct the flow. However, this method over-simplifies the influence of wall and surrounding blood motion on local measurements, which produce large, non-physical velocity gradients, requiring excessive smoothing operations to remove. We propose a new approach based on the Vorticity-Stream Function ($\psi$-$\omega$) formulation that yields more physiologically accurate velocity gradients and avoids any added smoothing operations. Zero-penetration conditions are specified at the walls, removing the need for measurement of wall velocity from additional scans, which introduce further uncertainties in the reconstruction. Inflow and outflow boundary conditions are incorporated by prescribing Dirichlet boundary conditions. The proposed solver is compared against the VFM using computational data to evaluate measurement improvement. Finally we demonstrate the method by evaluating murine left ventricle Color Doppler scans.

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