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Automatic classification of pathological left ventricular flows based on modal decomposition MARIA GUADALUPE BORJA, ANDREW M. KHAN, UC San Diego, PABLO MARTINEZ-LEGAZPI, CHRISTIAN CHAZO, JAVIER BERMEJO, Hospital Gregorio Maranon, Madrid, Spain, JUAN C. DEL ALAMO, UC San Diego, U Washington — Despite increasing evidence that left ventricular (LV) flow patterns reflect cardiac health, recent advances in non-invasive LV flow imaging have not been translated into improved diagnosis of cardiac dysfunctions. Ad-hoc flow metrics, such as vortex circulation or pressure gradients, are rigorously based on flow physics. However, they often rely on simplifying assumptions about LV flow and may not fully reflect yet-to-be-discovered interdependencies between flow and cardiac physiology. Thus, we investigated whether unbiased analysis of LV flow can be used to classify healthy and diseased LVs. To this end, we performed modal decompositions (POD and DMD) of 2D and 1D flow fields obtained by color-Doppler echocardiography in healthy subjects and patients with hypertrophic (HCM) or dilated cardiomyopathy (DCM). To isolate flow features from those associated with LV wall motion / shape, each patient's flow was represented in a rectangular stationary domain. Subjects were binary-classified as healthy/DCM and healthy/HCM according to their flow's projection onto canonical sets of DMD/POD modes obtained for the three cohorts. The number of modes used for classification was chosen by grid search, and the performance of the classification was tested by k-fold cross-validation. Receiver operating characteristic curves showed excellent performance for both DMD and POD, and both 1D and 2D flow fields, with areas under the curve between 0.81 and 0.96.

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