# Parametric Anatomical CAD Model Generation with Silicone Phantom Fabrication Tools for Validation Studies

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**Abstract** – Adaptable shape models of critical cardiovascular anatomy sections have been developed to accelerate population-oriented studies of pathological morphology. A method developed to assist *in vitro* investigations on aortic valves shall be presented in this research. To investigate aortic valve function, a parametric model of the left ventricular outflow tract-to-ascending aorta (LVOT-to-AA) region was developed utilizing Dassault Systemes' modeling software SolidWorks. This parametric model facilitates incremental changes for studying patient population variances and disease progression. The LVOT-to-AA model was dissected using a novel geometry-specific method so that mold-sets could be developed. Fabricating these mold-sets using 3D-printing techniques allowed the model to be cast in parts. A LVOT-to-AA silicone phantom was produced using transparent silicone for use in a mock circulatory system (MCS) for analysis. This MCS can produce a wide range intraventricular conditions and systemic circulation responses. An aortic valve silicone phantom investigation box was fabricated out of transparent acrylic plate and fittings to allow for particle image velocimetry (PIV) flow analysis. The MCS can reproduce the pulsatile flow withstood by aortic valves *in situ* for a variety of patient types and time-variant conditions. A study of valve morphologies against an array of circulatory conditions will be presented. The architecture of the model will be discussed with a workflow illustrating the execution of models for computational work and experimental flow study validation.