Evaluation of ventricular assist systems through target patient models

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Abstract – The performance of ventricular assist systems is largely affected by the cardiovascular flow conditions and the shape of the anatomy proximal to the implanted device. The interrelation of the flow conditions and the geometry in the investigation space demands the incorporation of both aspects into the evaluation of these technologies. Computational models are effective at identifying performance characteristics of designs and their response against a wide array of operating conditions. Experimental validation is still a fundamental step in the development process, but has been largely encumbered by the pace of simulation and lack of flexibility to execute many conditions. Inclusion of anatomical geometry in both elements of modeling drastically complicates the processes by nature of the implementation, rate of simulation, and compounding nature of using other geometry. Utilizing MathWorks model-based design tools and physical modeling packages, evaluation of a left ventricular assist design using lumped parameter system models progressing to computational fluid dynamics models will be shown. Translation to an experimental system will show how to perform the verification and validation (V&V) of the computational results. Formation of the method around virtual patient models, in terms of flow conditions and anatomical shape models, enhances the resulting clinical guidance from the outcomes.