ROSTOCKTESTCASE – OPEN ACCESS GEOMETRY AND HIGH-FIDELITY FLOW SIMULATION RESULTS OF A VENTRICULAR ASSIST DEVICE FOR NUMERICAL VALIDATION

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Introduction

Numerical flow simulations in ventricular assist devices (VADs) are crucial for the development and optimization of these devices. They help to evaluate the pump performance, the stress field and to make statements about the hemocompatibility. The flow in a ventricular assist device is rather complex with turbulent flow characteristics and secondary flow structures. Therefore, flow validation of VAD simulation is important to ensure that the applied flow solver, the computational grid, and the simulation setup can represent the VADs flow. Regarding that, the research group "Rotary Blood Pump" at the University of Rostock provides a freely available test case of an axial ventricular assist devices on which interested researchers can test their simulation setup and compare their results with the results of a high-fidelity large-eddy simulation of the VAD flow.

Method

The test case is available at: https://unibox.uni-rostock.de/getlink/fi8AE4mYS4kxu8ZY51oxDh/
A documentation of the test case can be found at: https://kbwiki.ercoftac.org/w/index.php/AC7-03

Results

The full 3D geometry of the VAD, as well as detailed information about the grid generation, simulation setup, and experimental validation, can be found at these links. High-fidelity large-eddy simulation results of the stress fields are shown and compared with a state-of-the-art Reynolds-averaged Navier-Stokes simulation. In addition, blood damage prediction results are published.

Conclusion

The test case offers simulation engineers in the field of cardiac support a validation possibility of their numerical methods. In addition, the simulation methodology in the test case is well documented, providing researchers with a good overview for this purpose.

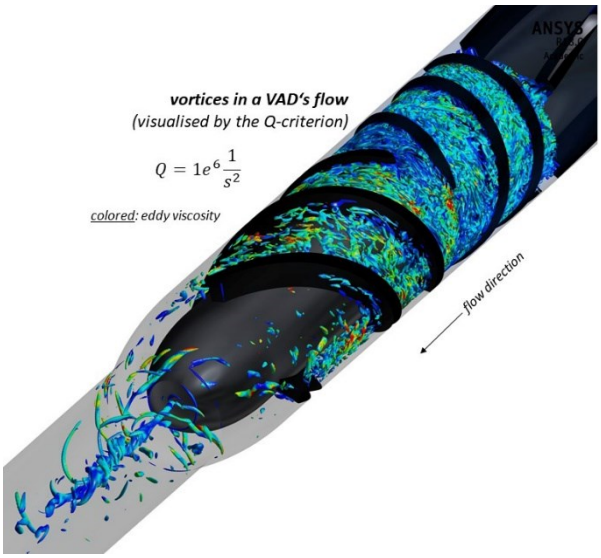

Figure 1: Turbulence-resolving simulation of the flow in an axial ventricular assist device. The iso-surfaces show turbulent eddies, visualized by the Q-criteria.

Figure 2: QR code to the Testcase.