

ROM-based Optimization for Industrial Applications

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Abstract

This presentation introduces the ROM technologies developed by ESTECO, thanks also to the experience gained in the course of ARIA project, to offer a wide and complete design optimization solution for our industrial customers, fully integrated in the web-based collaborative platform VOLTA.

To demonstrate the efficiency of the solution, we illustrate the results of the MDO optimization of a centrifugal blood pump, originally designed by the U.S. Food and Drug Administration (FDA). These pumps are usually employed to assist the heart ventricles in pumping blood to the patient's body (ventricular assist devices or VADs). However, the device reliability, as well as mechanical blood damage (hemolysis), still represent a serious challenge in clinical applications, limiting their potential benefits.

In this study, we have optimized the FDA pump combining CFD analysis and ROM evaluations, through a fully automatic process guided by our web-based collaboration platform VOLTA. Optimal compromise solutions between pump efficiency and hemolysis damage have been achieved, taking into account also the stability of the performance at the variation of the uncertain mass flow rate. Consequently, the integration of ROM methodologies in the optimization platform has allowed to reduce drastically the overall computational time to achieve these results.