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Using Proper Orthogonal Decomposition and Dynamic Mode Decomposition for comparing CFD and experimental results in unsteady aerodynamics AMANDINE GUISSART, THOMAS ANDRIANNE, GRIGORIOS DIMITRIADIS, VINCENT TERRAPON, University of Liege — Typically, the integration of Experimental Fluid Dynamics (EFD) and Computational Fluid Dynamics (CFD) allows a better understanding of the flow of interest by leveraging the complementary of their respective data. The comparison of computational and experimental results is an important but difficult step of this integration, particularly in the case of unsteady flows. This work presents a method for quantitative comparison of unsteady aerodynamic data using two decomposition methods: the Proper Orthogonal Decomposition (POD) and the Dynamic Mode Decomposition (DMD). It is applied to extract the dominant structures of the flow around a static and oscillating 4:1 rectangular cylinder. The experimental and numerical data are obtained through two-dimensional Time-resolved Particle Image Velocimetry (Tr-PIV) measurements and unsteady Reynolds-Averaged Navier-Stokes (uRANS) simulations, respectively. The results illustrate the complementarity of the two decomposition methods. It is also shown that this approach represents a powerful tool enabling the analysis and the quantitative comparison of the main spatial (POD) and temporal (DMD) characteristics of unsteady flows.

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