Data-Driven Approach to Fluid Engineering

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Abstract: In our laboratory, we have been conducting research focusing on a data-driven approach to fluid engineering for design. Designing aerospace machines, these days requires more advanced factors. The recent development of supercomputer leads that we must treat more complex flow phenomena that brings uncertainty, with the more advanced design considered. Such as a reduced-order model and a data assimilation method, to estimate and reduce the uncertainty in numerical simulations, are potential ways to assist the advanced design. That is by use of experimental or observational data and numerical analysis of physical equations. Recently, we are focusing on observation sensitivity, in order to improve the accuracy of data assimilation. The impact of observation is estimated by an empirical observability gram matrix, which is consist of finite bases that are the features of the target unsteady flow field. We are interested in physical quantity to evaluate the observability and to clarify the suitable basis for constructing the gram matrix. This semi-plenary lecture summarizes our recent results of the optimization of the observation position by the atmospheric model for wind power generation, and the physical sensitivity evaluation by extraction of the characteristic structure of the unsteady transonic buffet phenomenon around the aircraft wing, etc.

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