Multi-variable structural optimization of high-aspect-ratio wings using POD

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There have been numerous researches on Fluid-Structure Interaction (FSI) regarding the analysis and design of aircraft structures. The studies of FSI using Reduced Order Model (ROM) have been carried out as well. For the FSI analysis process which iteratively conducts structural and aerodynamic analysis to find equivalent state, it is effective to construct ROM. Moreover, application of ROM is very efficient for design optimization of FSI problems. The contents of this paper focus on the use of ROM in structural optimization of a high-aspect-ratio aircraft wing involving a large number of design variables. The responses of structure analysis are projected onto the results of aerodynamic analysis by Proper Orthogonal Decomposition (POD). Then, as the design variables are changed, the varying results of FSI analysis can be promptly achieved even if the number of design variables is large. A multi-variable wing optimization problem is demonstrated using proposed algorithm using POD.

Keywords: Fluid-Structure Interaction, Structural Optimization, Reduced Order Model, Proper Orthogonal Decomposition