FM24S_12652

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

POD Analysis of Coherent Structures in Turbulent Flows

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POD (proper orthogonal decompositions) is an efficient method to extract turbulent coherent structures. In this paper, POD technique is applied to the study of turbulent natural thermal convection between two vertical plates and the study of planar compressible mixing layer flow, based on DNS database. Both the direct POD method and the snapshots method are applied in the former case; only snapshots method is applied to the analyzing of the mixing layer flow by reason of the data size. The distribution of energy among POD modes has been closely examined. The most energetic structures are extracted, respectively spiral structures and streamwise vortexes in natural convection and span-wise vortices, turbulent structure etc. in mixing layer. It has been observed that the flow structures in the experiment match well with the ones in POD, and these structures are the essential characteristic of these flows. The direct method and the snapshots method have also been compared in this paper.

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