파동 난류에서 임의 위상-진폭 이론

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RPA theory in Wave Turbulence

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Key Words: Wave Turbulence(파동난류), RPA(임의 위상-진폭), Hamilton mechanics(해밀톤 역학), Clebsch variable(클렙쉬 변수), Multi-mode PDF(멀티모드 확률밀도함수)

Abstract : We develop a generalized RPA(random phase and amplitude) formalism in wave turbulence(WT). RPA theory employ the Hamiliton mechanics description, derived directly from the 3-D inviscid and incompressible Navier-Stokes equation through the Clebsch transformation. We expand randomness even toamplitudes beside phases of wave-like motions. The newly derived equation is also a wave kinetic equation(WKE). We explooit the PDF analysis to analyze the WKE and obtain some new good results. Those are based on PDF analysis from the analysis of WT spectrum, the exact solution of the Hamilton equation.

A Dynamic Globalization Model for Large Eddy Simulation of Complex Turbulent Flow

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복잡한 난류유동장의 큰 에디모사를 위한 동적 광역화 모델

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Key Words: Dynamic model(동적모델), Large eddy simulation(큰 에디모사), Turbulence flow(난류)

Abstract : A dynamic subgrid-scale model is proposed for large eddy simulation of turbulent flows in complex geometry. The eddy viscosity model by Vreman [Phys. Fluids, 16, 3670 (2004)] is considered as a base model. A priori tests with the original Vreman model show that it predicts the correct profile of subgrid-scale dissipation in turbulent channel flow but the optimal model coefficient is far from universal. Dynamic procedures of determining the model coefficient are proposed based on the 'global equilibrium' between the subgrid-scale dissipation and viscous dissipation. An important feature of the proposed procedures is that the model coefficient determined is globally constant in space but varies only in time. Large eddy simulations with the present dynamic model are conducted for forced isotropic turbulence, turbulent channel flow and flow over a sphere, showing excellent agreements with previous results.