

# NOTES ON NUMERICAL FLUID MECHANICS

Volume 15

---

Ulrich Schumann  
Rainer Friedrich (Eds.)

---

Direct and Large  
Eddy Simulation  
of Turbulence



---

Vieweg

Ulrich Schumann  
Rainer Friedrich (Eds.)

# Direct and Large Eddy Simulation of Turbulence

Proceedings of the EUROMECH Colloquium No. 199,  
München, FRG, September 30 to October 2, 1985



Friedr. Vieweg & Sohn      Braunschweig/Wiesbaden

## CONTENTS

	Page
1. TRANSITION TO TURBULENCE	
N. GILBERT, L. KLEISER: Subcritical Transition to Turbulence in Channel Flow . . . . .	1
T. HERBERT: Vortical Mechanisms in Shear Flow Transition . . . . .	19
2. SUBGRID-SCALE MODELS AND BASIC CONCEPTS	
B. AUPOIX: Subgrid Scale Models for Homogeneous Anisotropic Turbulence .	37
W. D. McCOMB: Application of Renormalization Group (RG) Methods to the Subgrid Modelling Problem. . . . .	67
E. LEVICH: Helical Fluctuations, Fractal Dimensions and Path Integral in the Theory of Turbulence . . . . .	82
3. LARGE EDDY SIMULATIONS OF WALL-BOUNDED SHEAR FLOWS	
S. GAVRILAKIS, H. M. TSAI, P. R. VOKE, D. C. LESLIE: Large-Eddy Simulation of Low Reynolds Number Channel Flow by Spectral and Finite Difference Methods . . . . .	105
K. HORIUTI, A. YOSHIZAWA: Large Eddy Simulation of Turbulent Channel Flow by 1-Equation Model . . . . .	119
T. KOBAYASHI, M. KANO: Numerical Prediction of Turbulent Plane Couette Flow by Large Eddy Simulation . . . . .	135
D. LAURENCE: Advection Formulation of Large Eddy Simulation for Engineering Type Flows . . . . .	147
L. SCHMITT, K. RICHTER, R. FRIEDRICH: Large-Eddy Simulation of Turbulent Boundary Layer and Channel Flow at High Reynolds Number . . . . .	161
Short Contributions:	
J. KIM: Numerical Investigation of a Vortical Structure in a Wall-Bounded Shear Flow . . . . .	177

P. MOIN: Recent Results on the Structure of Turbulent Shear Flows using Simulation Databases . . . . .	181
<b>4. DIRECT AND LARGE EDDY SIMULATIONS OF MIXED SHEAR AND BUOYANT FLOWS</b>	
T. M. EIDSON, M. Y. HUSSAINI, T. A. ZANG: Simulation of the Turbulent Rayleigh-Benard Problem using a Spectral/Finite Difference Technique . .	188
G. GRÖTZBACH: Application of the TURBIT-3 Subgrid Scale Model to Scales Between Large Eddy and Direct Simulations . . . . .	210
K. KUWAHARA, S. SHIRAYAMA: Direct Simulation of High-Reynolds-Number Flows by Finite-Difference Methods . . . . .	227
U. SCHUMANN, S. E. ELGHOBASHI, T. GERZ: Direct Simulation of Stably Stratified Turbulent Homogeneous Shear Flows . . . . .	245
<b>Short Contribution:</b>	
R. W. METCALFE, S. MENON, J.J. RILEY: The Effect of Coherent Modes on the Evolution of a Turbulent Mixing Layer . . . . .	265
<b>5. CONVECTIVE OR STABLE ATMOSPHERIC BOUNDARY LAYERS</b>	
D. J. CARRUTHERS, J. C. R. HUNT, C. J. TURFUS: Turbulent Flow near Density Inversion Layers . . . . .	271
C.-H. MOENG: A Large Eddy Simulation Model for the Stratus-Topped Boundary Layer . . . . .	291
F. T. M. NIEUWSTADT, R. A. BROST, T. L. van STIJN: Decay of Convective Turbulence, a Large Eddy Simulation . . . . .	304
<b>6. SUMMARIZING STATEMENTS ON RESULTS, TRENDS AND RECOMMENDATIONS . . . . .</b>	
List of Participants . . . . .	336
List of Authors . . . . .	340