

Numerical Simulation of Turbulent Flows - LES

شبیه‌سازی عددی جریان‌های آشفته

Contents

1. Introduction
2. The equations of fluid motion
3. Mean flow equations
4. Turbulence: a short review
5. Reynolds-Averaged-Numerical-Simulation (RANS)
6. Large-Eddy Simulation (LES)
7. Spectral description, modeling, and simulation
8. An introduction to Probability Density Function (PDF) method

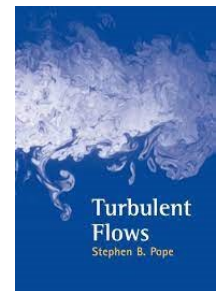
سرفصل

۱. مقدمه
۲. معادلات حرکت سیال
۳. معادلات متوسط جریان
۴. توربولانس: مروری کوتاه
۵. شبیه‌سازی متوسط رینولدزی (RANS)
۶. شبیه‌سازی گردابه بزرگ (LES)
۷. توصیف، مدل‌سازی و شبیه‌سازی طیفی
۸. مقدمه‌ای بر روش تابع چگالی احتمال (PDF)

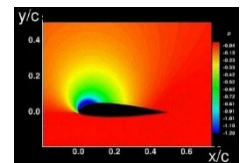
Main References

Books

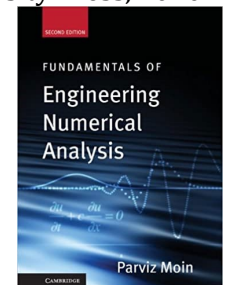
- [1] Pope, S.B., Turbulent flows, Cambridge University Press, 2000.



- [2] Davidson, L., Fluid mechanics, turbulent flow and turbulence modeling, Course notes: Chalmers University of Technology, 2023.



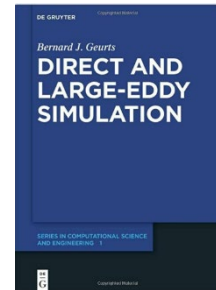
- [3] Moin, P., Fundamentals of engineering numerical analysis, Cambridge University Press, 2010.



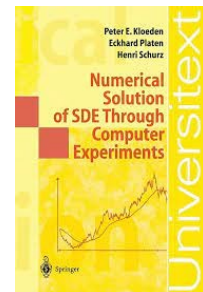
[4] Canuto, C., Hussaini, M.Y., Quarteroni, A., and Zang, T.A., Spectral methods, 2 volumes, Springer, 2007.



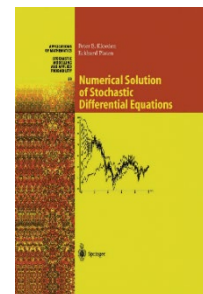
[5] Geurts, B.J., Direct and large-eddy simulation, De Gruyter, 2020.



[6] Kloeden, P.E., Platen, E., and Schurz, H., Numerical solution of SDE through computer experiments, Springer, 2002.



[7] Kloeden, P.E., and Platen, E., Numerical Solution of Stochastic Differential Equations, Springer, 1992.



Notes

[8] Notes on numerical simulation of turbulent flows, by B. Lessani, Amirkabir University of Technology

[9] Notes on LES of turbulent flows, by R. Stoll and J.A. Gibbs, University of Utah

Journals and papers

- Journal of computational physics (Journal, Elsevier)

Course material:

My github: <https://github.com/ehsan-amani/Courses/tree/main/NSTF-LES>

Websites

- Center of Turbulence Research (CTR), <http://ctr.stanford.edu>
- Johns Hopkins Turbulence DataBase (JHTDB), <http://turbulence.idies.jhu.edu>
- CFD of Multiphase flows group: <https://sites.google.com/view/dramani>

Other References

Books

- L. Davidson, An Introduction to Turbulence Models, 2018, Chalmers University of Technology.


Papers

- Morinishi, Yohei, et al. "Fully conservative higher order finite difference schemes for incompressible flow." Journal of computational physics 143.1 (1998): 90-124.
- Amani, Ehsan, Mohammad Bagher Molaei, and Morteza Ghorbani. "Novel mixed approximate deconvolution subgrid-scale models for large-eddy simulation." Physics of Fluids 36.8 (2024).
- Ham, F. E., F. S. Lien, and A. B. Strong. "A fully conservative second-order finite difference scheme for incompressible flow on nonuniform grids." Journal of Computational Physics 177.1 (2002): 117-133.
- Sauer, Timothy. "Numerical solution of stochastic differential equations in finance." Handbook of computational finance. Berlin, Heidelberg: Springer Berlin Heidelberg, 2011. 529-550.

Assessment

Homework	30%
Projects	50%
Final exam	20%

*Special thanks to professor **Bamdad Lessani**, my master. With what I learned from him, the preparation of this course material became possible.*

 **CHARLOTTE**

MECHANICAL ENGINEERING AND ENGINEERING SCIENCE
The William States Lee College of Engineering

ABOUT MEES | UNDERGRADUATE PROGRAM | GRADUATE PROGRAMS | RESEARCH


[Home](#) / [About MEES](#) / [Faculty Directory](#) / Bamdad Lessani

BAMDAD LESSANI

GIVE NOW

ABOUT MEES

- About the Department
- Register for a MEES Tour
- Academic Calendar
- Calendar of Events
- Faculty Directory
- Bamdad Lessani



Mechanical Engineering and Engineering Science
TEACHING ASSOCIATE PROFESSOR

DCH 269
704-687-8335
blessani@uncc.edu

Education

- Ph.D., Free University of Brussels (Vrije Universiteit Brussel), 2003
- M.S. Institut National Polytechnique de Grenoble, 1998
- M.S. Sharif University of Technology, 1997
- B.S. Sharif University of Technology, 1994