

# LES of Turbulent Flows: Lecture 0

## (ME EN 7960-003)

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Fall 2014

# Some Books on LES

- **“Elements of Direct and Large-Eddy Simulation”**, 2004, Bernard J. Geurts.  
-A readable book covering everything from turbulence theory to LES subgrid scale models and numerical techniques. It contains mostly incompressible flow with some applications to compressible flow. While not as complete as some other books (measured by the number of different methods), this is a nice first book to go over.
- **“Large-Eddy Simulation for Incompressible Flows: An Introduction, 3<sup>rd</sup> Edition”**, 2006, Pierre Sagaut.  
-Not really an introduction but more of a nice reference for LES SGS model techniques. It contains some turbulence theory but its best information is on filtering and SGS models. Probably the most complete collection of SGS models in any one place. It can be a difficult read due to the effort to include so many references.
- **“Turbulent Flows”**, 2000, Pope, Stephen.  
-This book is not strictly speaking a book on LES. It is a book about incompressible turbulent flows that contains a very nice section on modeling. The modeling section includes a chapter on LES. The inclusion of general turbulence theory and LES together makes this book an ideal companion for texts that focus on LES and many times give brief or incomplete descriptions of the turbulent flow phenomena and mathematics the models are based on. Two related examples are isotropic turbulence theory (e.g., Kolmogorov’s hypothesis) and spectral analysis, both of which Pope gives excellent descriptions of.

## Some More Books on LES

- **“Mathematics of Large Eddy Simulation of Turbulent Flows”**, 2006, Berselli, Luigi, Iliescu, Traian and Layton, William.
  - This book is a nice text on LES focused on the mathematics of LES. It is written in the style of a math text book (complete with theorems, Lemmas, proofs and remark statements throughout the text). The mathematical viewpoint makes several sections very strong (including those related to filtering and approximate deconvolution) but at the same time makes the text a somewhat incomplete viewpoint of LES. For example phenomenological modeling strategies are not discussed. Some very important developments (e.g., dynamic modeling) are also missing from the textbook.
- **“Large-Eddy Simulations of Turbulence”**, 2005, Lesieur, Marcel, Metais, Olivier and Comte, Peirre.
  - This is a shorter compact text on LES. Of the textbooks listed here, it contains one of the better descriptions of LES of compressible flow. It is also one of the better references for EDQNM (eddy-damped quasi-normal Markovian) theory, spectral LES and structure function based SGS models. It is also the only text listed that explicitly discusses LES and atmospheric flows (although not in great detail).
- **“Implicit Large Eddy Simulation”**, 2007, Grinstein, Fernando, Margolin, Len and Rider, William.
  - This book is a collection of papers on implicit LES techniques. The papers are logically chosen to give the reader a good overview of the development and motivation of this technique. This book is a nice starting point for a researcher interested in using ideas from those working in implicit LES. The first 2 chapters give a nice introduction to the technique and the motivations and historical developments.

# Even More Books on LES

- **“Large Eddy Simulation of Complex Engineering and Geophysical Flows”**, 1993, Ed. Galperin, Boris and Orszag, Steven.

-One of the first comprehensive books on LES, this book is a collection of chapters from different authors chosen and arranged in a logical way to include a wide range of topics starting at a basic level with an introduction to SGS modeling and a historical overview of the development of LES and then moving into specific topic areas in geophysics and engineering. It includes several nice papers on building-block (“canonical” type) flows.

- **“Large Eddy Simulation of Turbulent Flows: Analytical and Numerical Results for a Class of LES Models”**, 2004, Volker, John.

-A mathematically minded text this book contains a lot of information. It takes a similar approach to Berselli et al. (2006) but is harder to read. Its organization has more of a class notes feel than a well developed text. One unique feature is that it does contain a chapter devoted to testing many of the models discussed in the text in actual flows (2D and 3D mixing layers).