

9.4: Chaos and Turbulence

This extremely short section consists of essentially just one statement, extending the discussion in Sec. 8.5. The (re-) discovery of the deterministic chaos in systems with just a few degrees of freedom in the 1960s has changed the tone of the debates concerning turbulence origins, very considerably. At first, an extreme point of view that equated the notions of chaos and turbulence, became the debate's favorite. ²³ However, after initial excitement, significant role of the Richardson-style energy-cascade mechanisms, involving many degrees of freedom, has been rediscovered and could not be ignored any longer. To the best knowledge of this author, who is a very distant albeit interested observer of that field, most experimental and numerical-simulation data carry features of both mechanisms, so that the debate continues. ²⁴ Due to the age difference, most readers of these notes have much better chances than their author to see where will this discussion end. ²⁵

²³ An important milestone on that way was the work by S. Newhouse et al., *Comm. Math. Phys.* **64**, 35 (1978), who proved the existence of a strange attractor in a rather abstract model of fluid flow.

²⁴ See, e.g., U. Frisch, *Turbulence: The Legacy of A. N. Kolmogorov*, Cambridge U. Press, 1996.

²⁵ The reader interested in the deterministic chaos as such may also like to have a look at a very popular book by S. Strogatz, *Nonlinear Dynamics and Chaos*, Westview, 2001.

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