Detecting strange attractors in turbulence: Takens' theorem and the Navier-Stokes equation

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Takens' celebrated time-delay embedding theorem allows the dynamics of a system to be reconstructed from a series of measurements at equally-spaced intervals of time. However, his original proof was only valid for generic dynamical systems evolving on finite-dimensional smooth manifolds. This was improved by Sauer, Yorke and Casdagli to apply to the attractors of finite-dimensional systems, but still excludes models of fluid dynamics and hence any application to physical turbulence. In this talk I will give an idea of the proof of a similar theorem for infinite-dimensional dynamical systems (e.g. parabolic partial differential equations). I will also give a simple proof of a result of Yorke that any periodic orbit of an ordinary differential equation $\dot{x} = f(x)$ with $|f(x) - f(y)| \leq L|x - y|$ must have period at least $1/L$, and a related infinite-dimensional result.