Lagrangian mixing in Plane Couette flow

a blog

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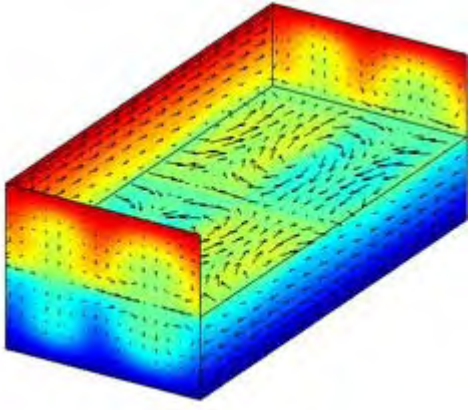
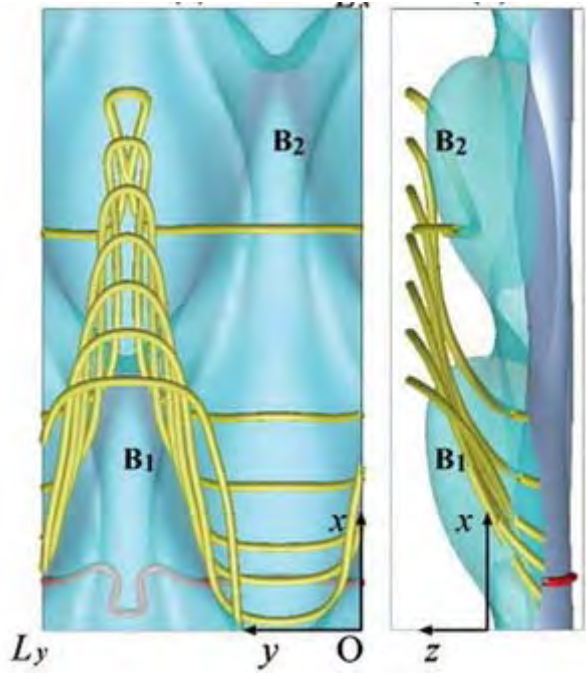
Visualization: Isosurfaces

Visualization of *3D* flow fields is a dark art. Consider these two visualization of the same **uEQ8**, or "hairpin vortex" equilibrium solution:

fixed sections of the Eulerian velocity field **u** = *(u,v,w)*



isosurfaces, vortex lines

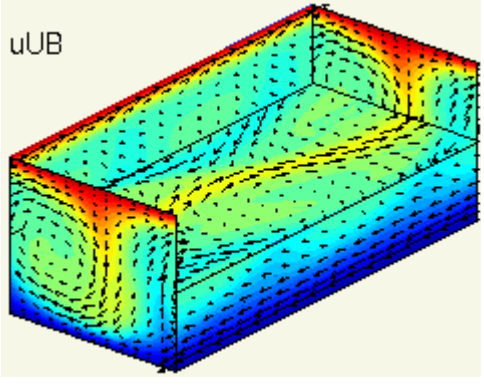


Itano and Generalis visualization:
yellow curves: vortex lines.
isosurfaces of ux = 0.1 and 0.4, (cyan and blue, respectively) reveal low-speed structures within the flow.

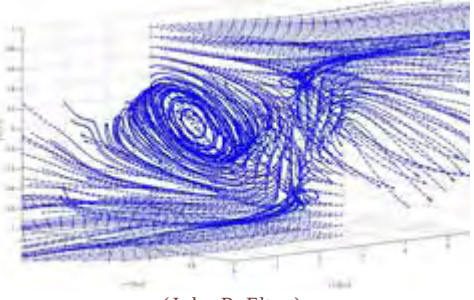
Visualization: Lagrangian mixing

Lagrangian particle trajectories of a spanwise - wall-normal sheet of initial "die" points, tracked until they cross the spanwise, streamwise (periodic b.c.) walls

Eulerian velocity field **u** = *(u,v,w)*, time independent



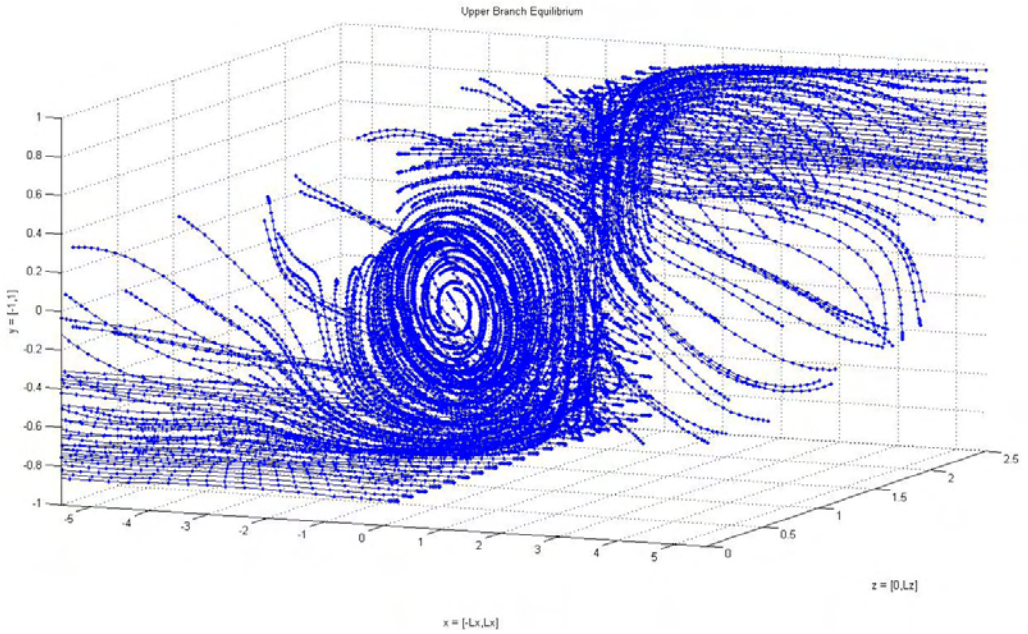
Lagrangian **x**(*t*) trajectories



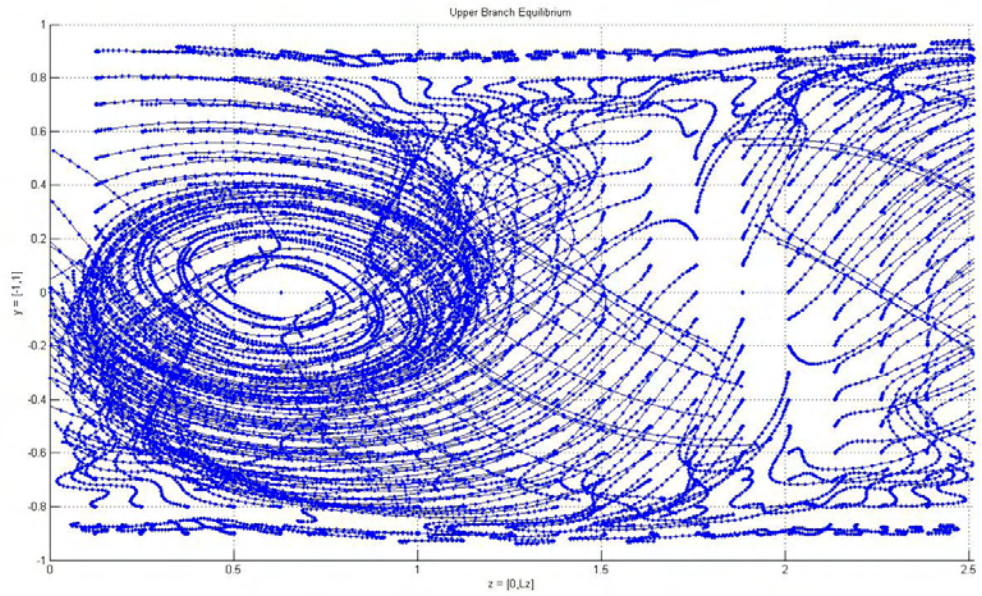
(John R. Elton)

uUB Nagata upper branch equilibrium.

Stagnation points, heteroclinic connections, periodic orbits can be determined for each Eulerian equilibrium solution.

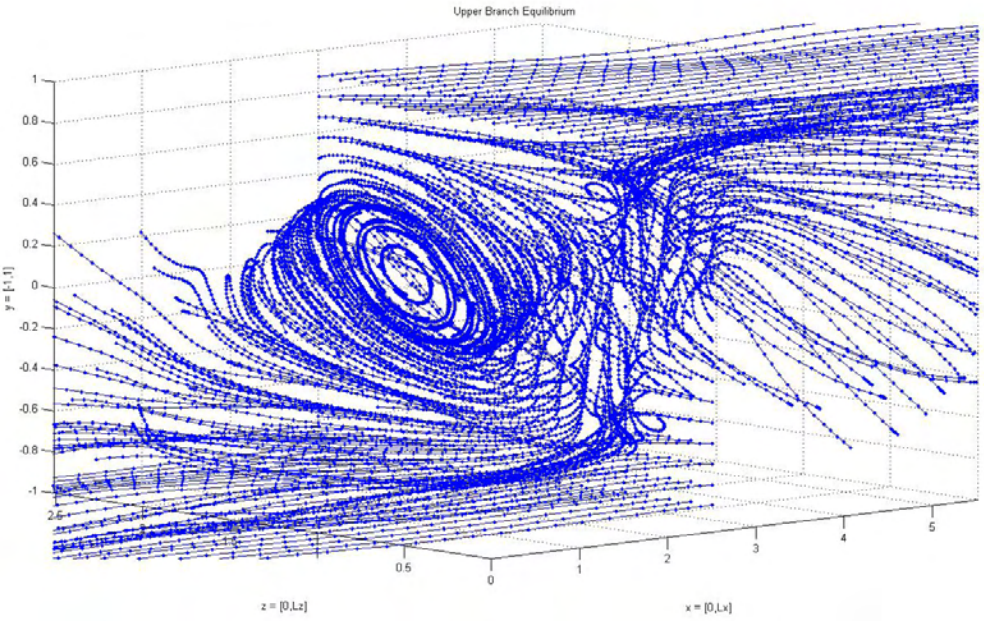


(a)

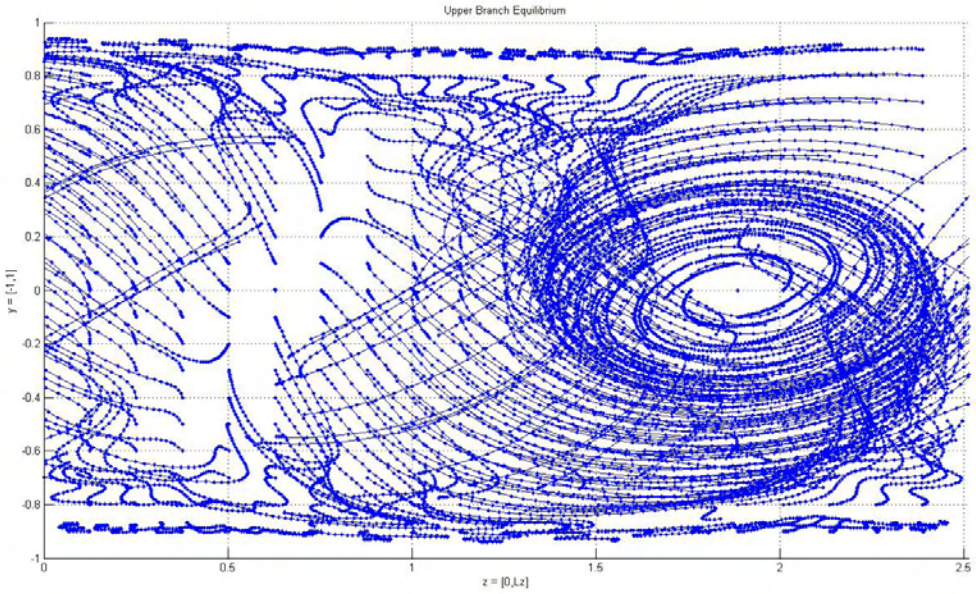


(b)

Figure 1.17: (a) Grid of 19×19 initial points in the $[y, z]$ plane, centered at $x = 0$; integrated for 15 time units. (b) Rotated to show the other 2 stagnation points.



(a)



(b)

Figure 1.16: (a) Grid of 19×19 initial points in the $[y, z]$ plane, centered at $x = L_x/2$; integrated for 15 time units. (b) Rotated to show the 2 stagnation points.

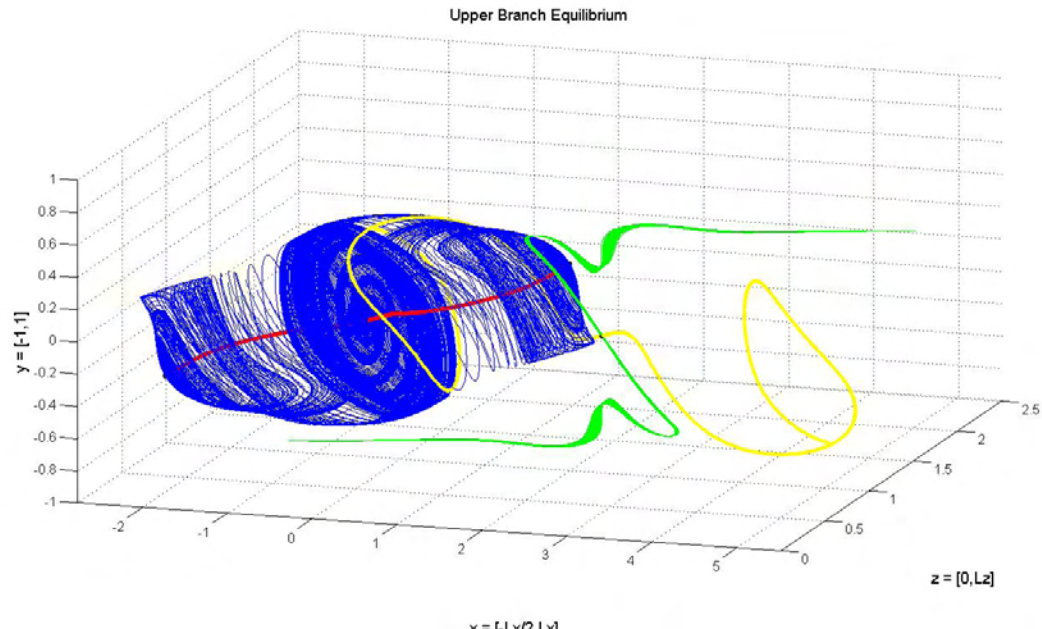


Figure 1.9: Full physical space relations between the stagnation points.

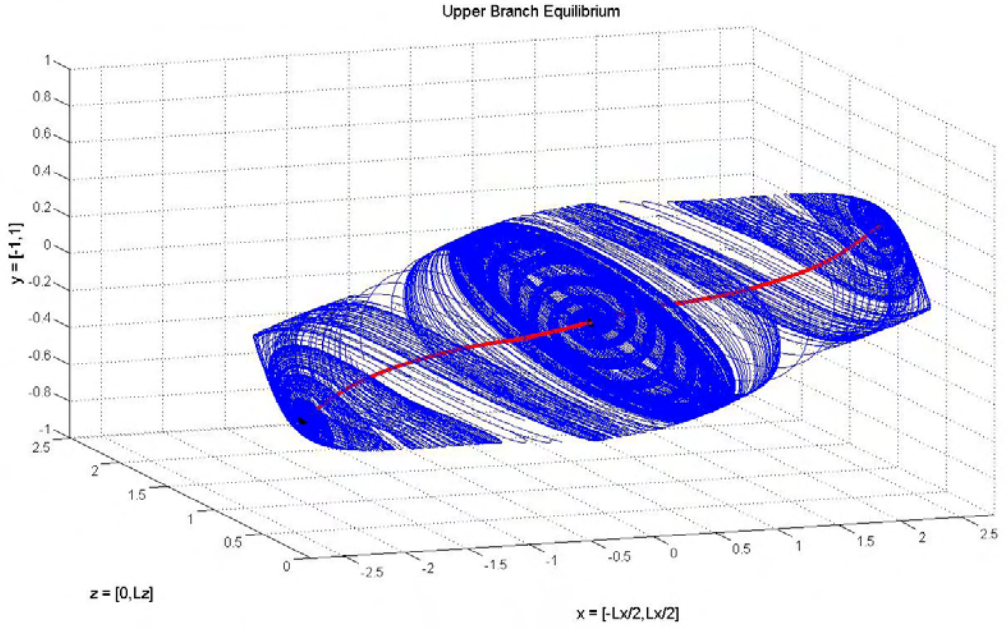


Figure 1.8: Heteroclinic pairs.

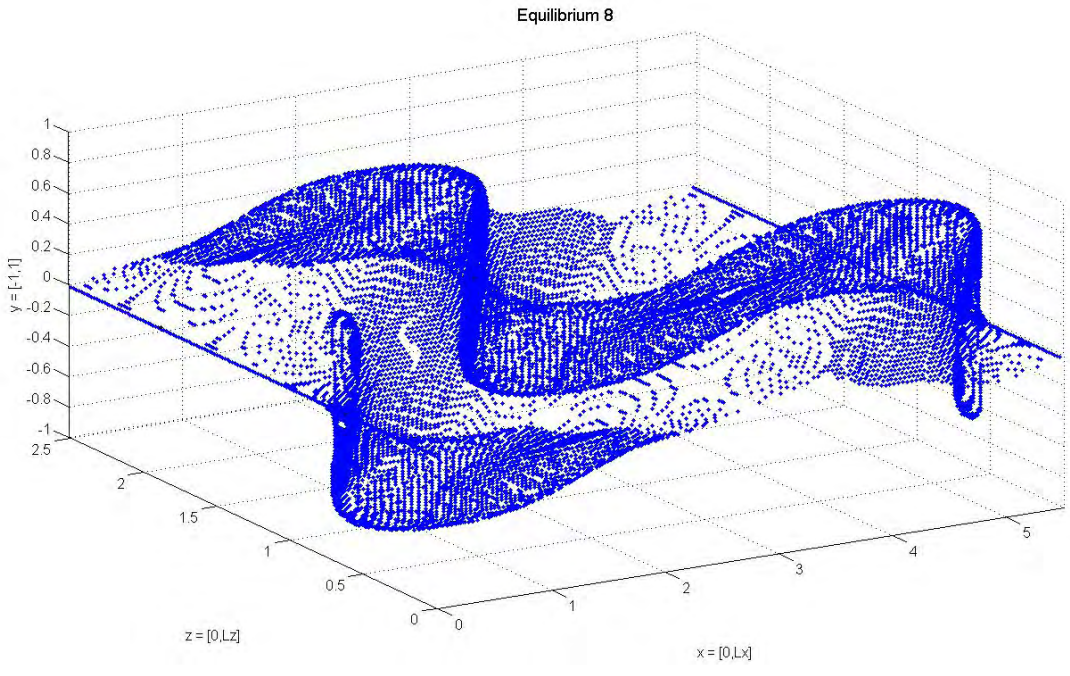


Figure 1.2: A plot of points whose value of velocity squared falls below an arbitrary cutoff of 5×10^{-7}. Perspective view.