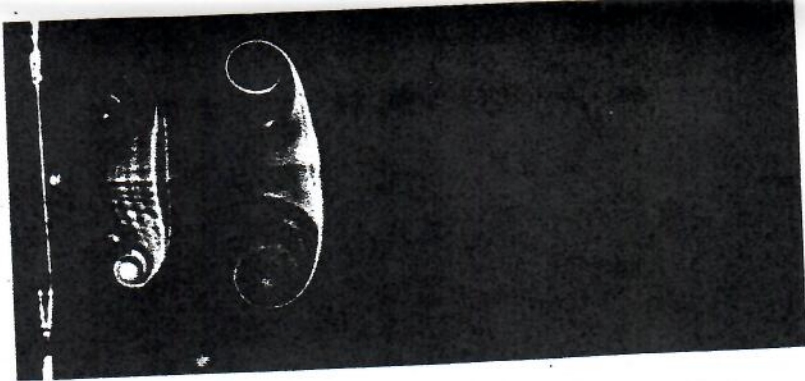
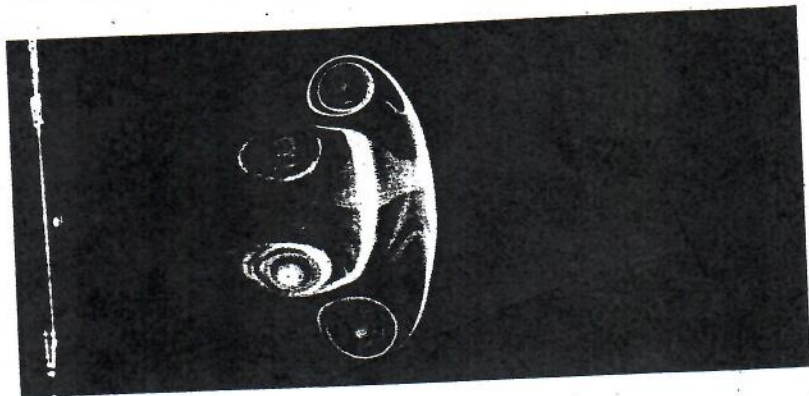


"INDUCED FLOW"

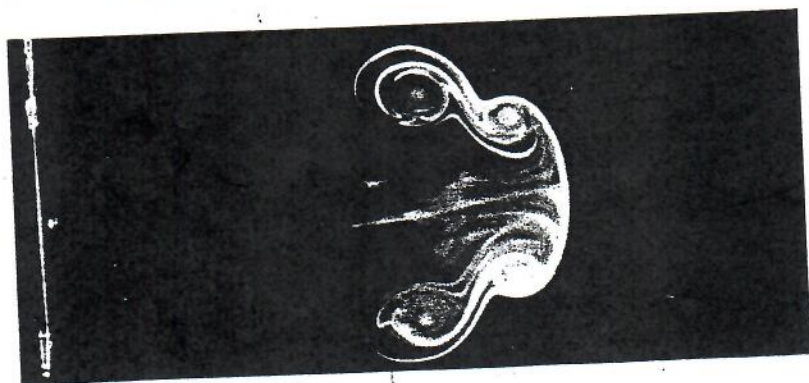


leapfrogging of
two "air-puff"
vortices.

(smoke wire
stretched across
diameter).

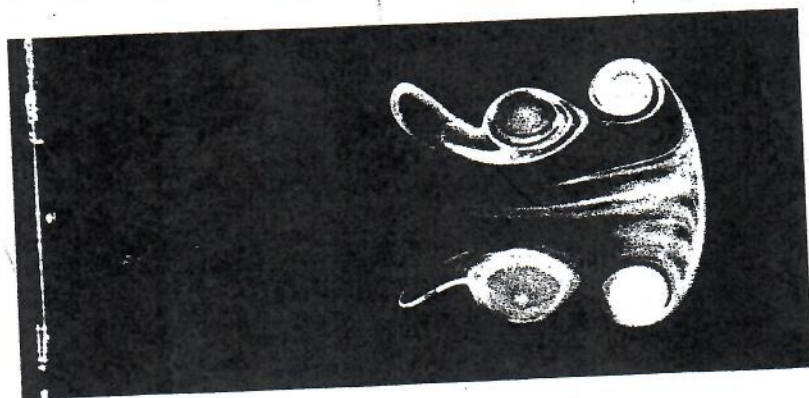


• 1st vortex
induces accel.
of trailing
vortex



• Trailing vortex
is propelled
through 1st.

• Then Repeated



- Example of
"non-local"
character of
N-S eqns,



Van Dyke's
Album of
Fluid
Mechanics.

← Yamada &
Matsui
1978

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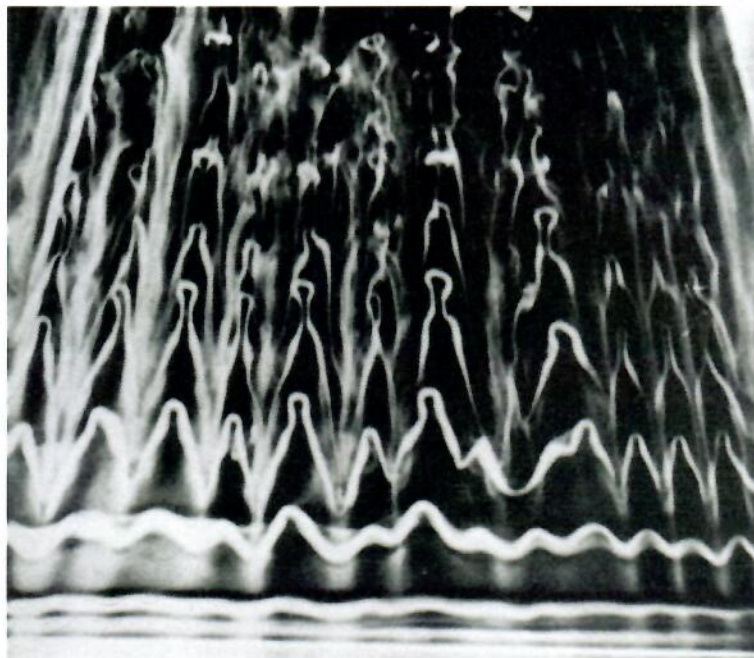
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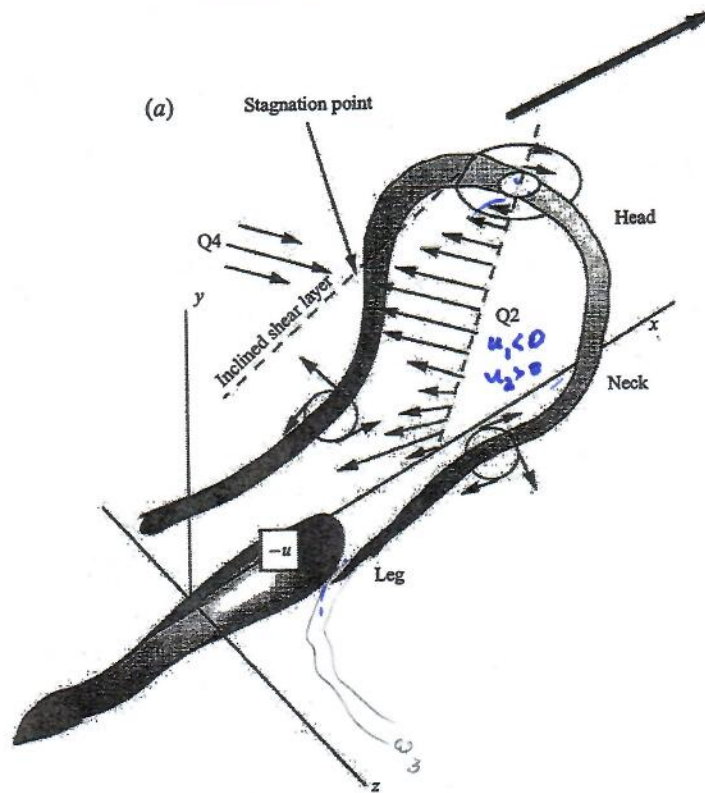
NCFMF

**Title:** Hairpin vortices**Description:** Hairpin vortices created by a boundary layer trip wire. Smoke in air.Visit T. T. Lim's web site at <http://serve.me.nus.edu.sg/limtt/>.**Credits:** T. T. Lim**References:** Perry, A.E., Lim, T.T. & Teh, E.W. (1981) A visual study of turbulent spots, JOURNAL OF FLUID MECHANICS, Vol 104, 1981, 387 - 405.**Web Page:****Contributed By:**

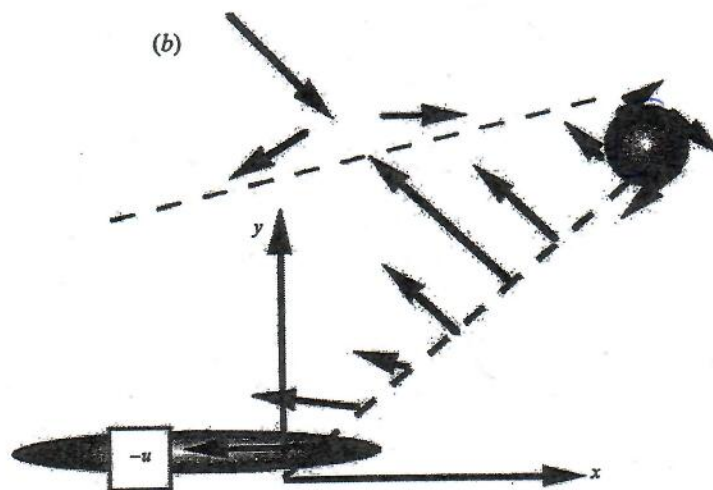
→ z



The eFluids editor for videos is G. M. "Bud" Homsy (bud@engr.ucsb.edu) and for images is Jean Hertzberg (Hertzberg@colorado.edu). Please contact them if you have any problems, questions, or concerns related to the gallery or videos and images. © Copyright on the videos is held by the contributors. Apart from Fair Use, permission must be sought for any other purpose.



"upward deflection" will advect faster away from the wall



These are being advected - need to subtract \bar{U}_{conv}

FIGURE 10. (a) Schematic of a hairpin vortex attached to the wall and the induced motion. (b) Signature of the hairpin vortex in the streamwise-wall-normal plane. The signature is insensitive to the spanwise location of the plane, until it intersects the concentrated core forming either side of the hairpin.

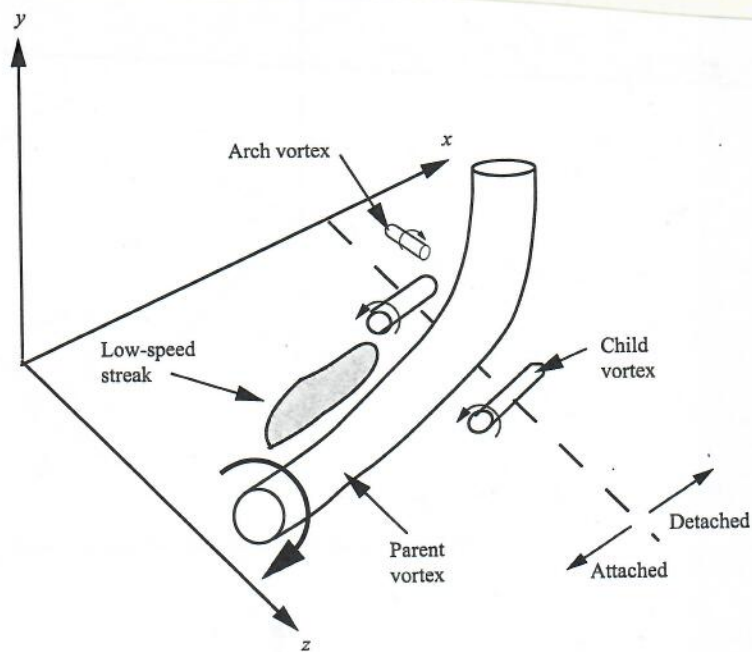


Fig. 4.40 Parent vortex showing where new streamwise and spanwise offspring are likely to arise.

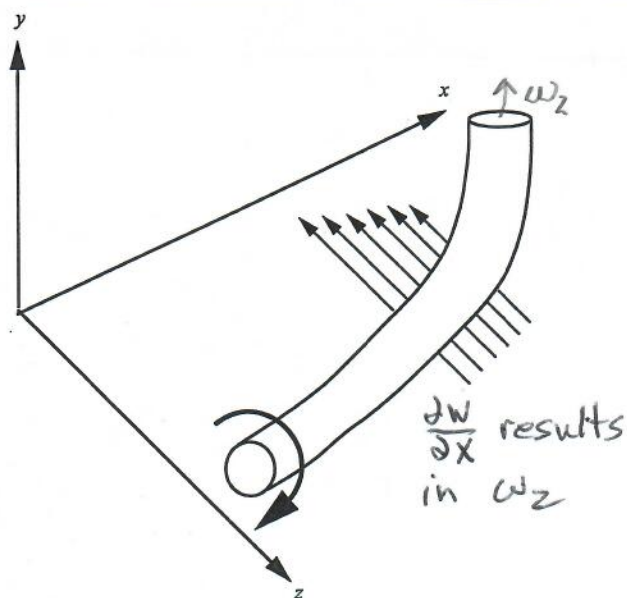


Fig. 4.41 Spanwise velocity gradients are created where the parent vortex detaches from the wall.

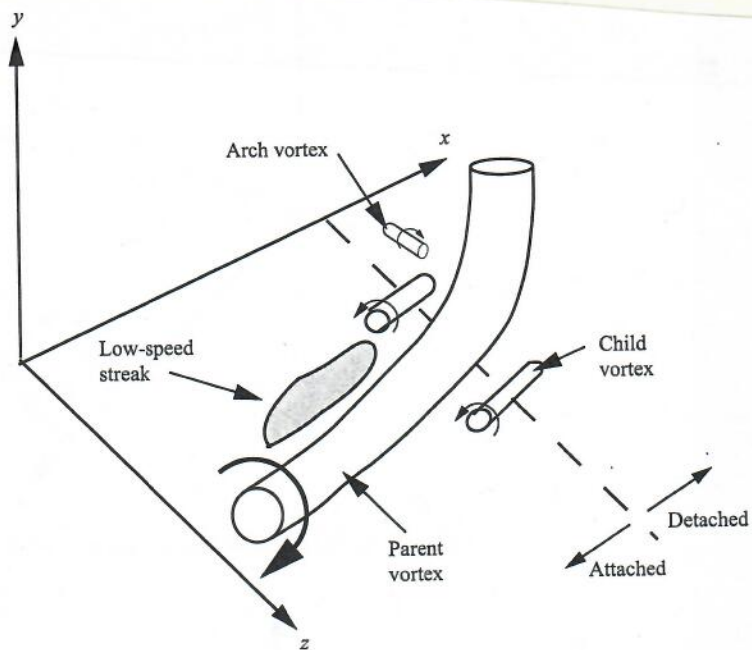


Fig. 4.40 Parent vortex showing where new streamwise and spanwise offspring are likely to arise.

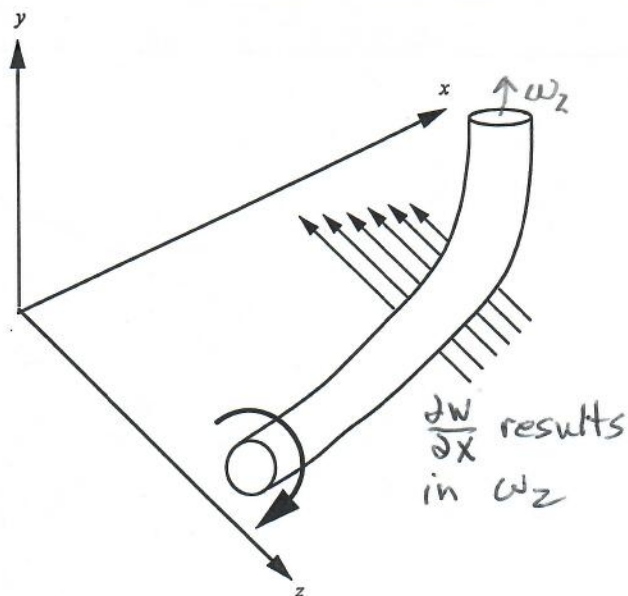
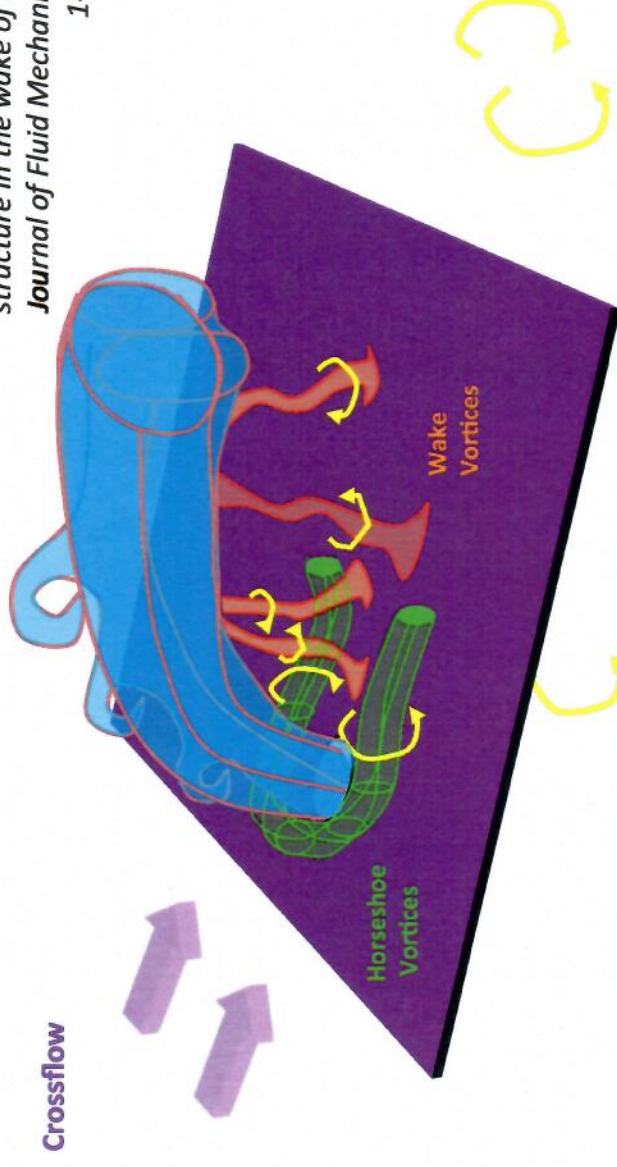


Fig. 4.41 Spanwise velocity gradients are created where the parent vortex detaches from the wall.

- JICF structure is strongly three-dimensional
- Steady and Unsteady components

As described by: Frick, T.F., Roshko, A, "Vortical structure in the wake of a transverse jet", Source: *Journal of Fluid Mechanics*, v 279, Nov 25, 1994, p 1-47



Vortex movies

→ Ring vortex interactions APS gallery 2017 - colliding vortices 3 minutes

<https://gfm.aps.org/meetings/dfd-2017/59b7fbecb8ac316d38841c31>

→ Vortex ring vortices with different geometries and interactions

<https://www.youtube.com/watch?v=oGGRxE2ijl0>

→ Vortex ring hitting a wall

<https://www.youtube.com/watch?v=1QTfA1ep2HU>

Turbulent Jet video 30 sec showing vortex strands

→ <https://www.bing.com/videos/search?q=turbulent+jet+flow&&view=detail&mid=7B8EB0FF5FEA8D25CF647B8EB0FF5FEA8D25CF64&&FORM=VDRVRV>

Kelvin Helmholtz jet instability - Jet exit flow vis

<https://www.bing.com/videos/search?q=turbulent+jet+flow&&view=detail&mid=87EC94316F7BFA2652D687EC94316F7BFA2652D6&&FORM=VRDGAR>

Jets in cross flow Frick & Roshko JFM 1994

https://extremeexposure.photoshelter.com/gallery-image/Lava/G0000_ohTq.mols/I0000LF6K_nN12n4