



# Vortex Dynamics of Soap Films

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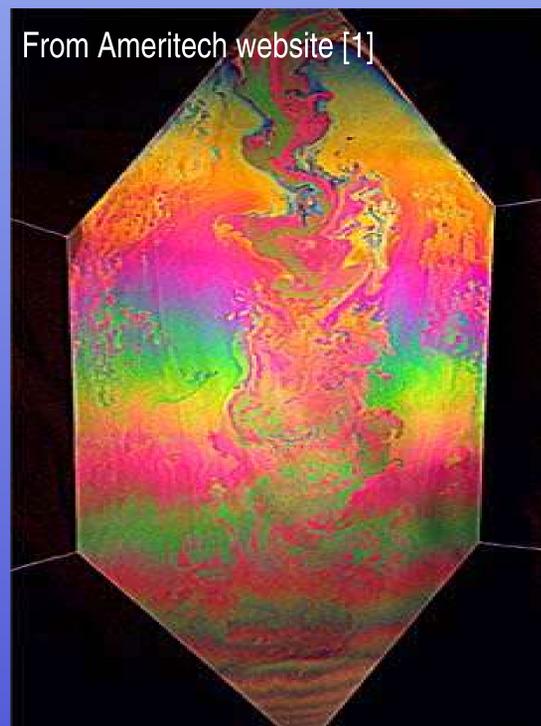
Lawrence Livermore National Laboratory,

## Background:

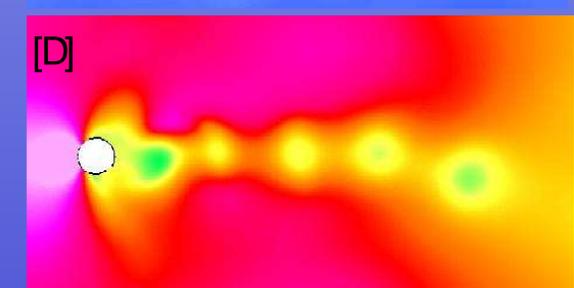
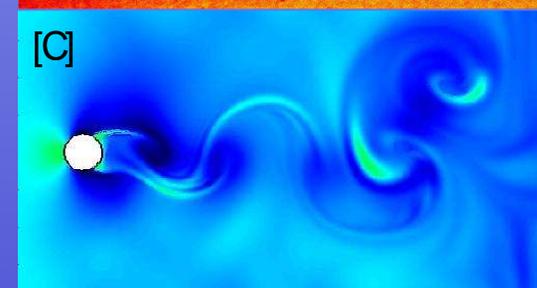
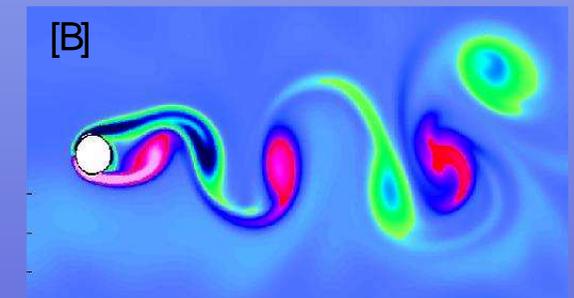
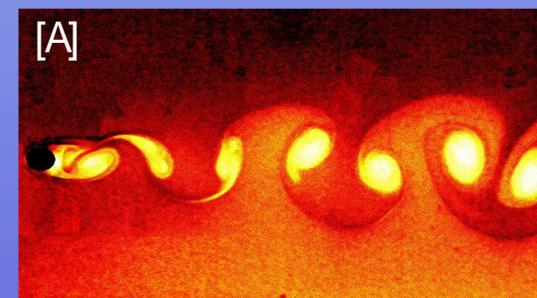
- Soap Films provide experimental realization of 2D flows under certain conditions
- Goal: to study Fluid-Structure interactions with particular emphasis on vortex shedding from elastic filaments
- Other reasons for study: biological flows, applications to atomization and sprays

## Method:

- Partial Differential Equation (PDE) formulation [3]
- OVERTURE: Computational framework developed at LLNL for solving PDE in complex geometries
- Primary Variables:
  - Planar Fluid Velocities
  - Film Thickness
  - Interstitial Soap-film Concentration
  - On-film Surfactant Concentration



## Results:



[A]: Vortices shed from circular cylinder at  $Re=140$  [4]

[B]: Contour plot of Vorticity for  $Re=150$ , (from simulations)

[C]: same as [B], but for Film Thickness

[D]: same as [B] but for On-film Surfactant Concentration

## References

- [1] <http://users.ameritech.net/paulcarlisle/soapfilms.html>
- [2] Zhang, Childress, Libchaber and Shelley, *Letters to Nature* Vol. 408, 2000
- [3] J.M. Chomaz, *J. Fluid. Mech.* vol. 442 pp 387-409, 2001
- [4] Vorobieff and Ecke, *Phys. Rev. E*, vol 60, No. 3, 1999