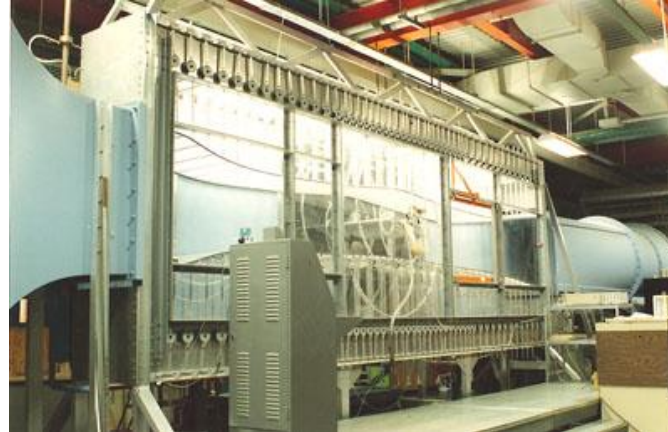


Fluid Group

- Cécile Devaud
- David Johnson
- Fue-Sang Lien
- Carolyn Ren
- Gordon Stubbley
- Sean Peterson
- Elizabeth Weckman
- Serhiy Yarusevych



Prof. Cécile Devaud

CFD for turbulent reacting flows



Flares

Combustion in engines

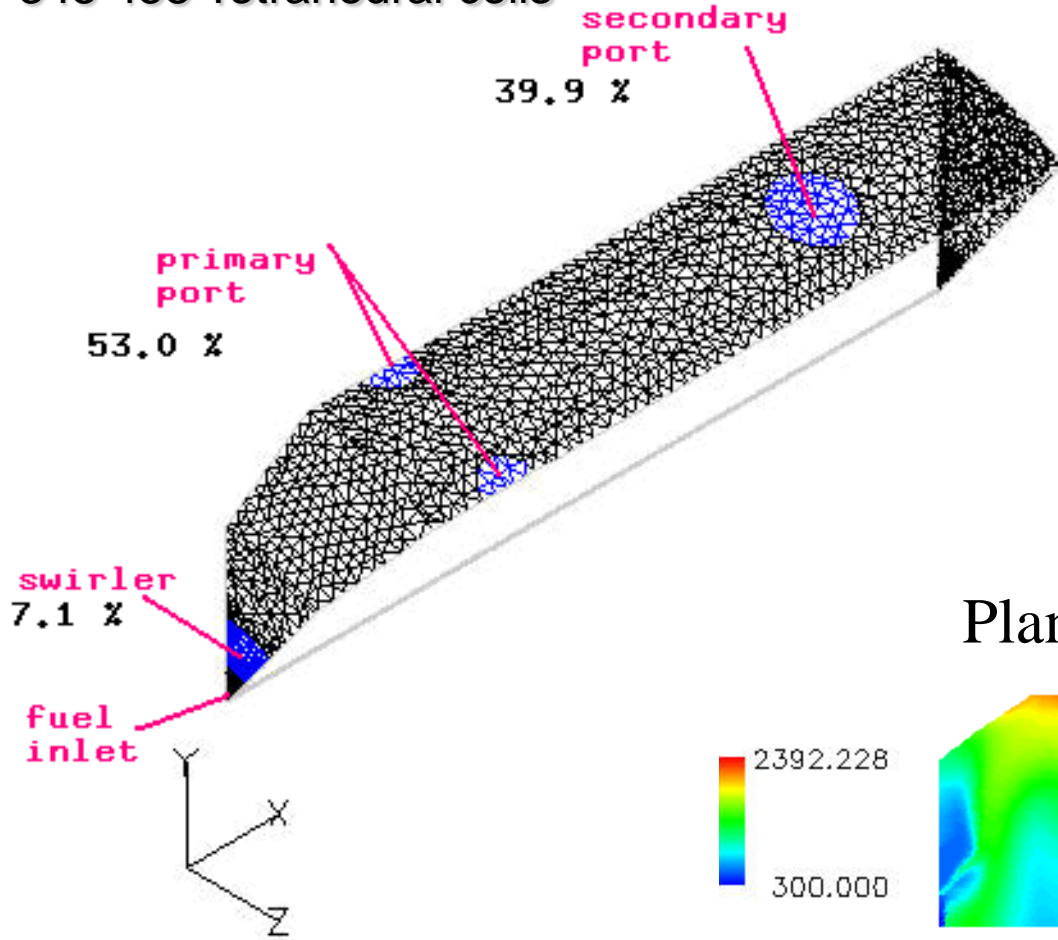


Gas turbines

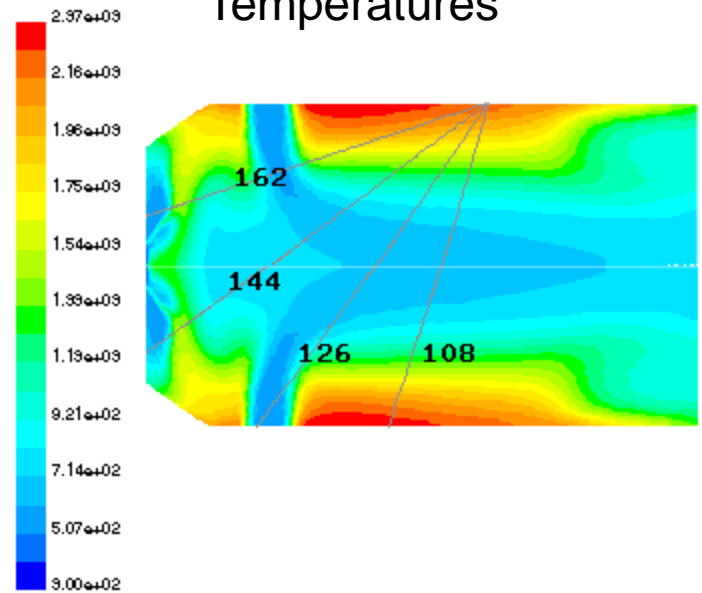


Automotive engines

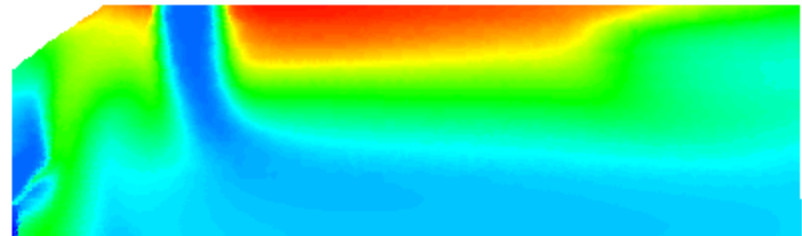
345 458 Tetrahedral cells



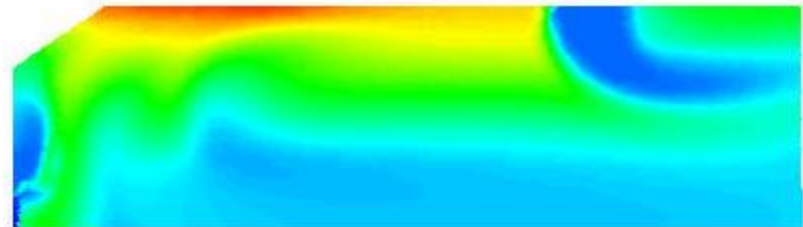
Temperatures



Plane through the primary holes



Plane through the secondary hole



Example: CFD of combustion in Rolls Royce Spay gas turbine engine

Research interests

- **Development and implementation of new mathematical models to reproduce the interactions between turbulence, combustion and heat transfer.**
- **Numerical modeling of turbulent combustion in engines.**
- **Investigation of alternative fuels to reduce emissions.**
- **For further info on available projects, please contact Prof. Devaud directly.**

cdevaud@uwaterloo.ca

Prof. David Johnson

- Wind Energy and **Wind Turbines**
- Large Scale PIV (Particle Image Velocimetry) and Measurement Techniques
- Turbomachinery (Turbines, Fans and Pumps)

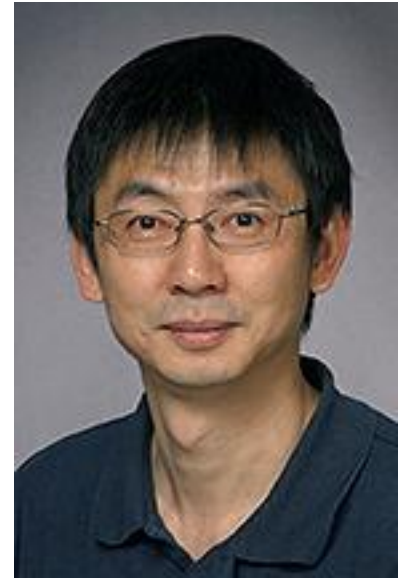




da3johns@mecheng1.uwaterloo.ca

Prof. Fue-Sang Lien

Computational Fluid Dynamics (CFD)



- Turbulence Modeling
- Aeroacoustics
- Indoor/Outdoor Dispersion**
- Uncertainty Quantification
- Detonation
- CO₂ Geological Storage

fslien@uwaterloo.ca



VANCOUVER 2010

XXI Olympic Winter Games

From the 12th to 28th February 2010

ELECTION

The city of Vancouver was elected Host City of the XXI Olympic Winter Games in 2010 at the 115th IOC Session in Prague on 2 July 2003. Eight cities applied to host the Games: Andorra la Vella in Andorra, Bern in Switzerland, Harbin in China, Jaca in Spain, PyeongChang in Korea, Salzburg in Austria, Sarajevo in Bosnia-Herzegovina and Vancouver in Canada.



Inner region

Release point



Image © 2007 DigitalGlobe
Image © 2007 TerraMetrics

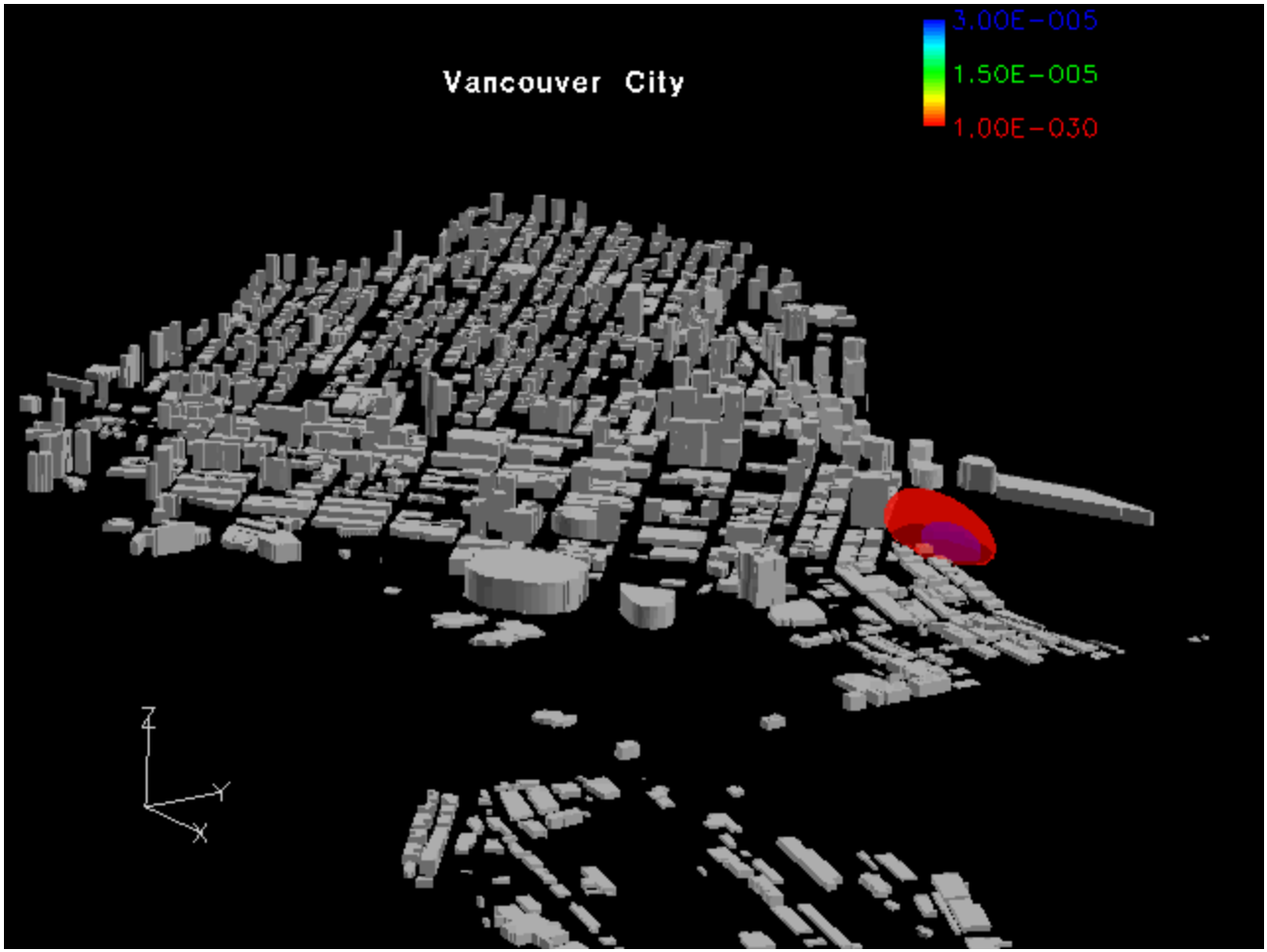
vancouver

© 2005 Google

Pointer 49°18'04.35" N 123°09'39.48" W elev 4 ft

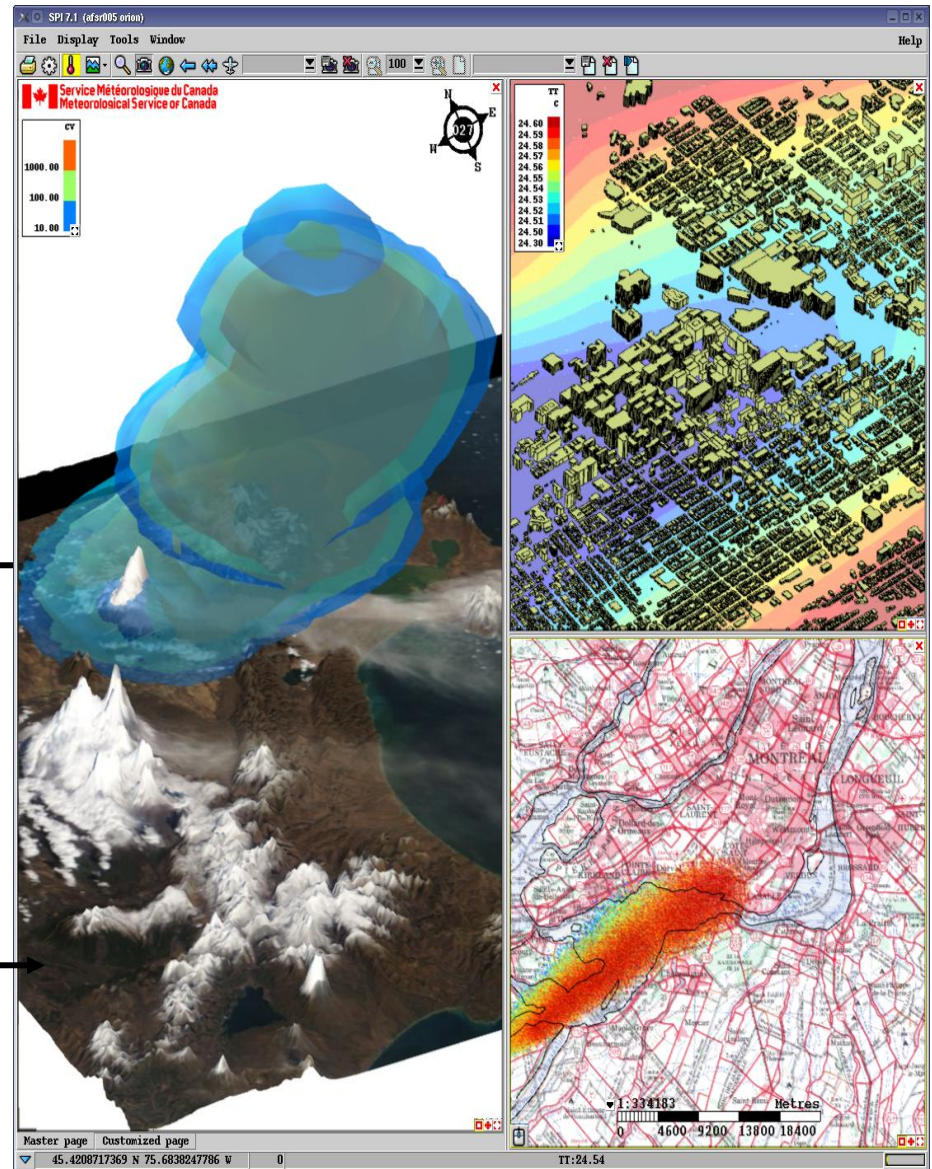
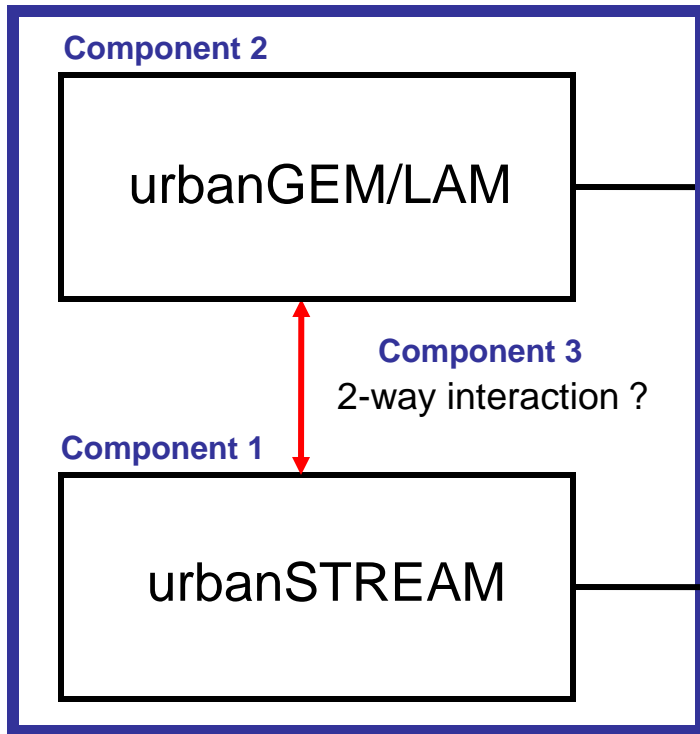
Streaming ||||| 100%

Eye alt 47424 ft



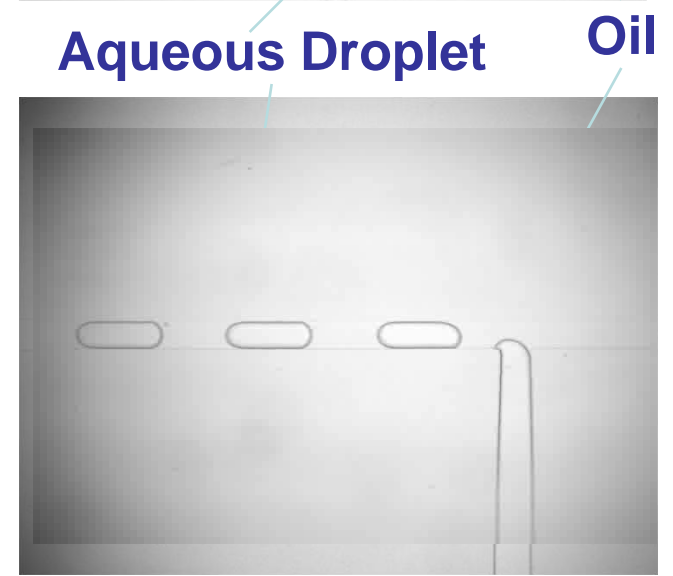
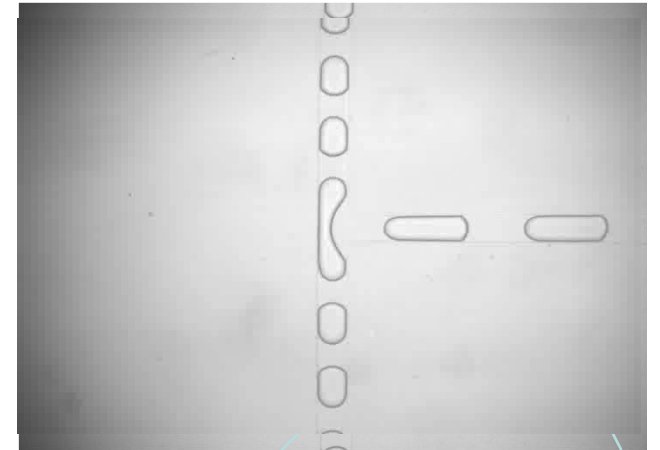
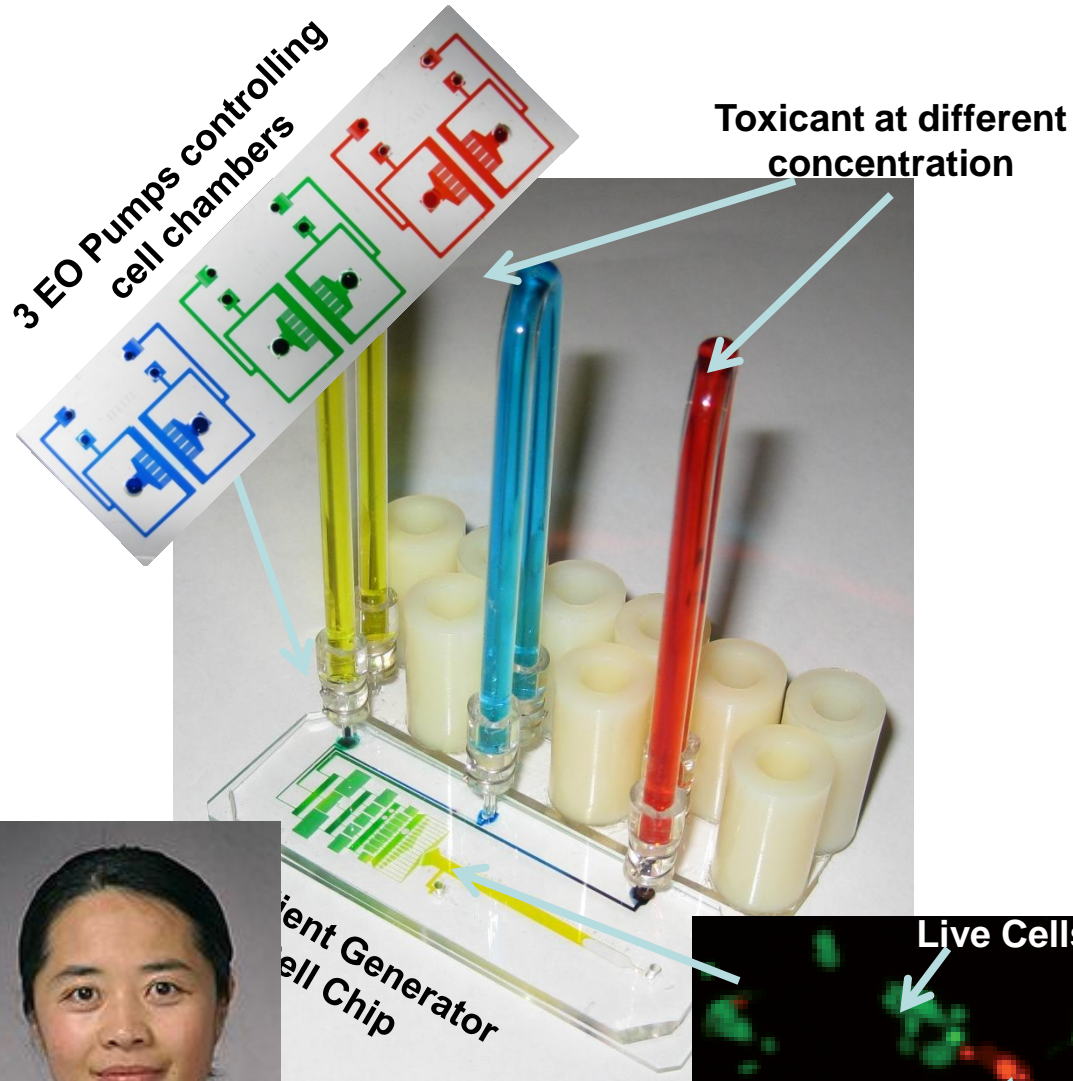
Multiscale Flow/Dispersion System

1. urbanGEM/LAM is a mesoscale code from Environment Canada
2. urbanSTREAM is a microscale CFD model



Flow models

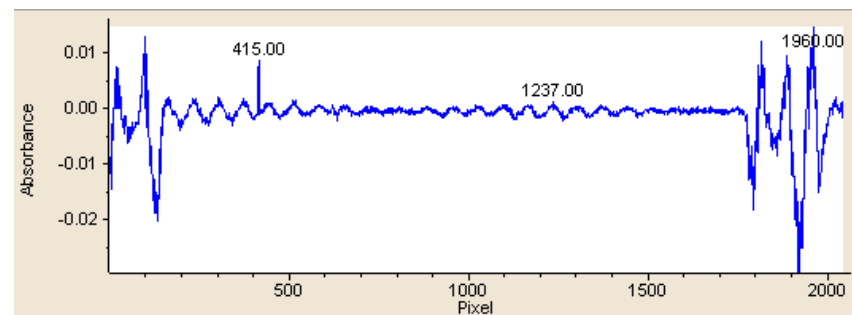
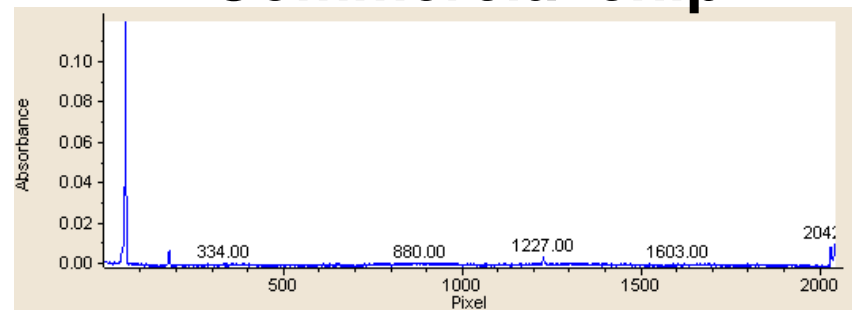
Toxicity Chip with Living Cells



Hemoglobin separation



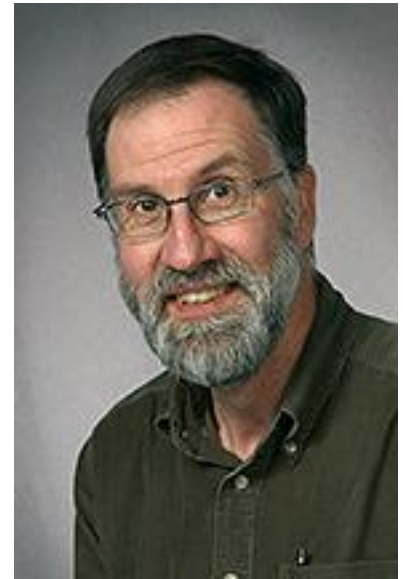
Commercial chip



Dr. Ren's chip

Prof. Ren – Microfluidics
and Biochip Lab

Prof. Gord Stubleley



- Computational fluid dynamics (CFD)
- Adaptive meshing technology
- Engineering Education**
- Engineering fluid mechanics

stubleley@uwaterloo.ca

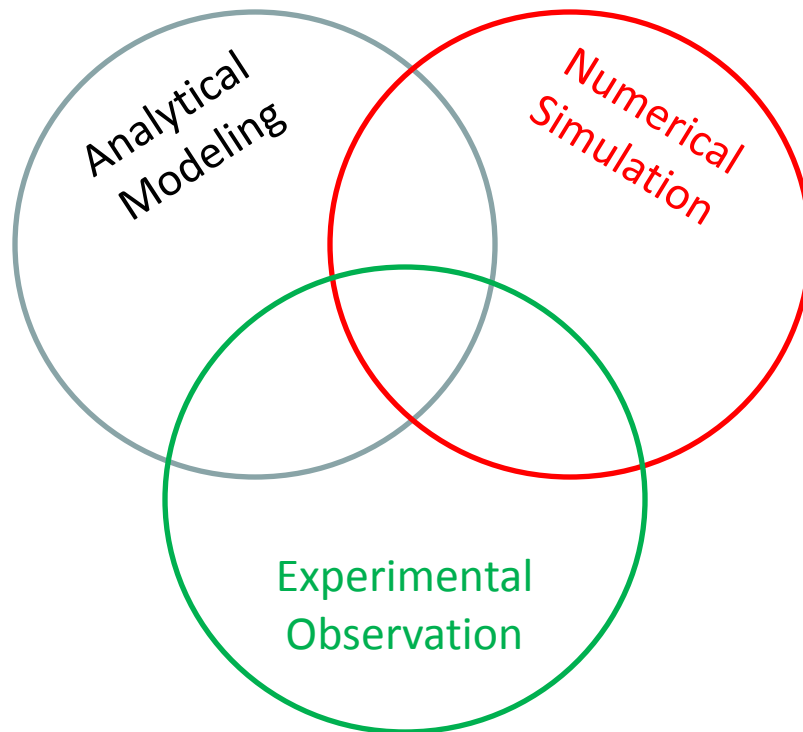
UW Fluid Flow Physics Group



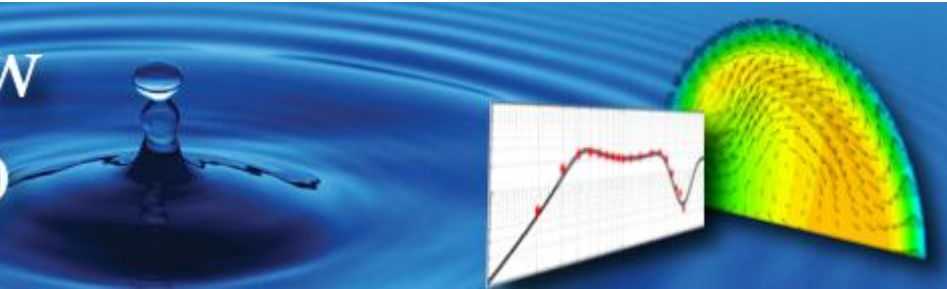
We study a variety of applied and fundamental problems in fluid mechanics using a variety of research tools



**Dr. Sean D.
Peterson**

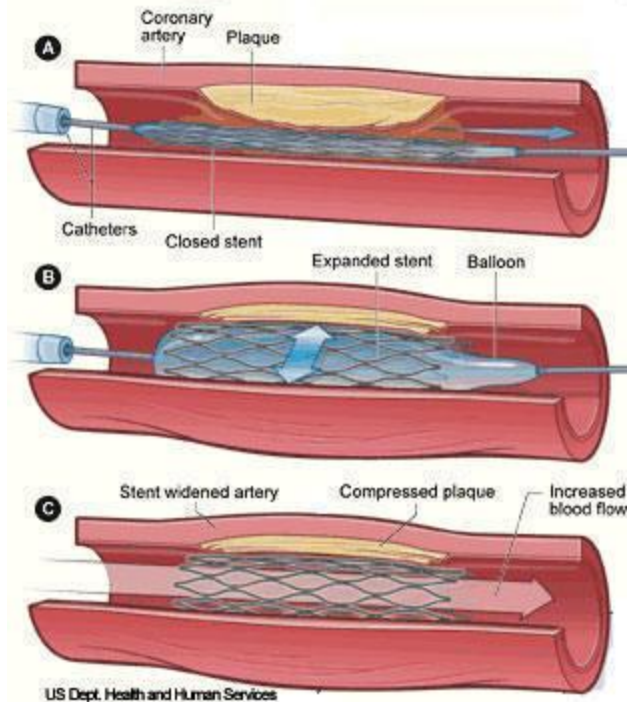


UW Fluid Flow Physics Group

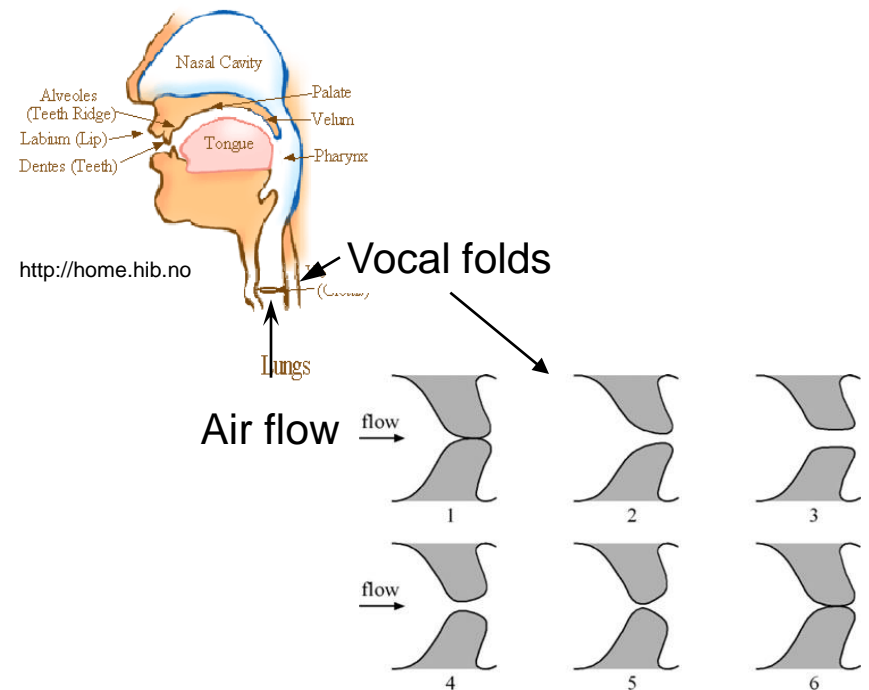


• Bio-fluid dynamics

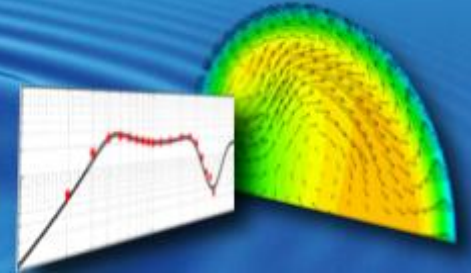
Assessing the role of fluid mechanics on stent life



Modeling speech to better understand voice disorders

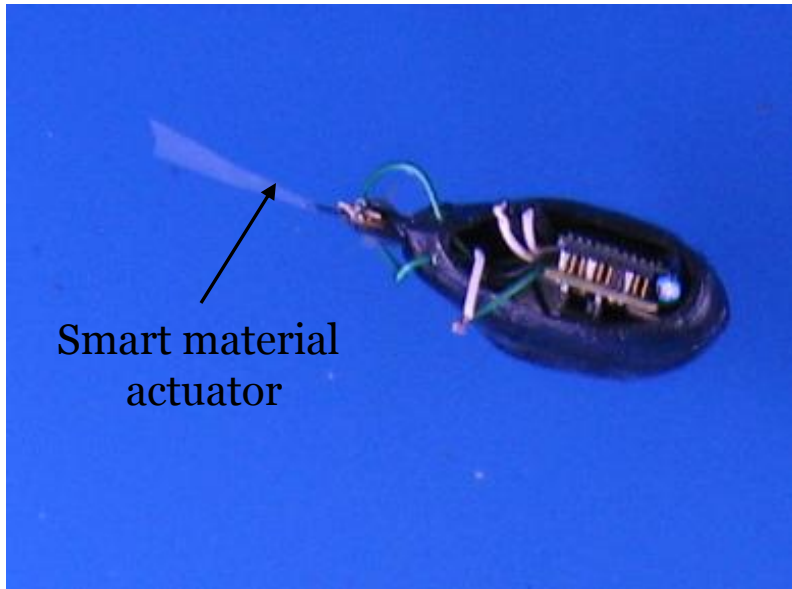


UW Fluid Flow Physics Group



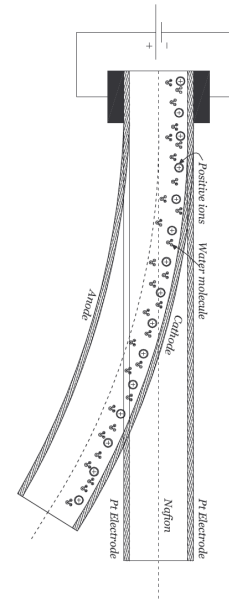
• Smart material/fluid interaction

Propulsion for small underwater vehicles

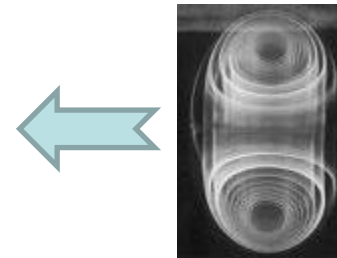


Smart material actuator

Energy harvesting from small-scale fluid structures to power small submerged devices



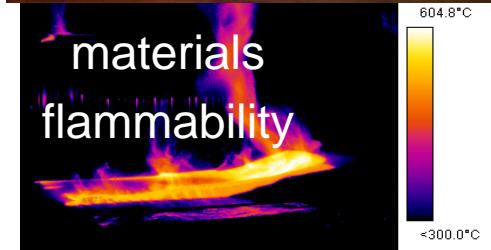
vortex ring



UW Fire Safety Research

Prof. Beth Weckman

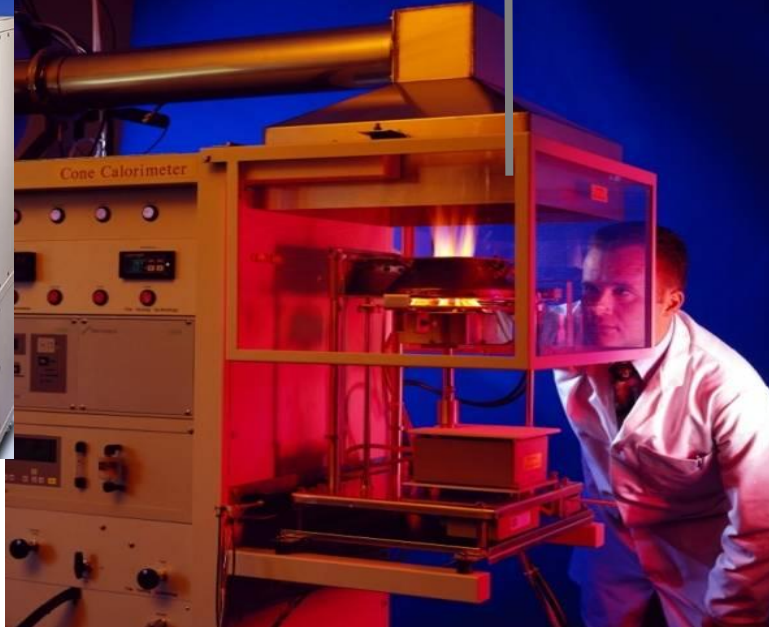
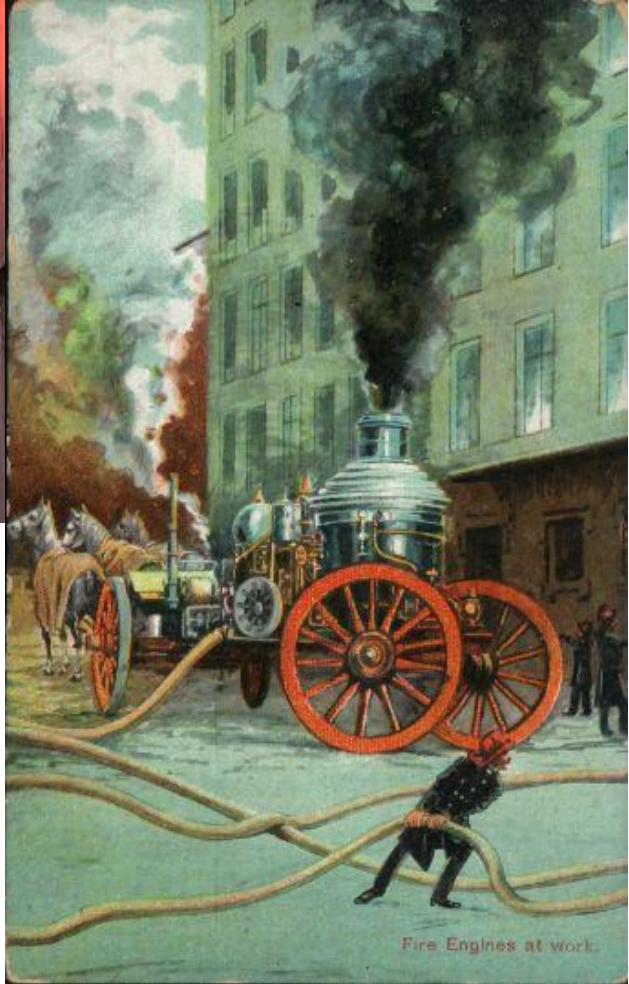
ejweckma@uwaterloo.ca



Field Tests

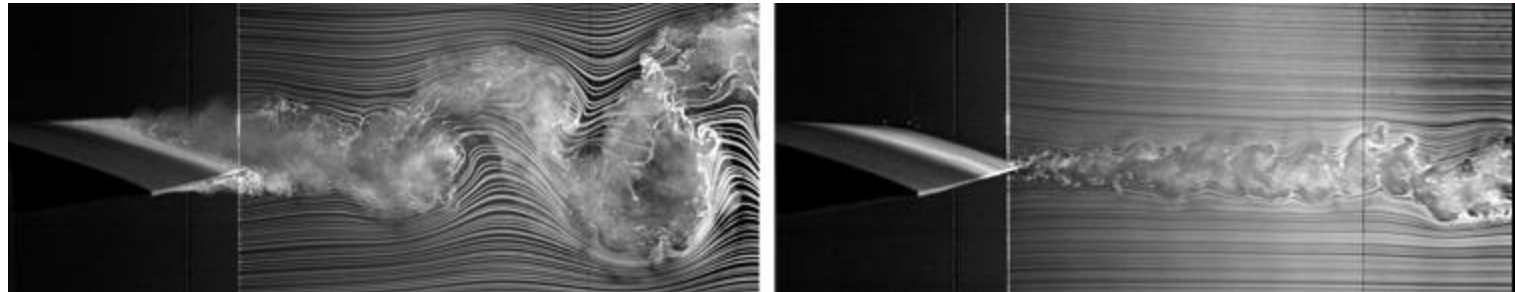


Technology, Science, Experience



Fluid Mechanics Research Lab

Prof. Serhiy Yarusevych (www.fmrl.uwaterloo.ca)



Research Interests:

- Applied Aerodynamics
- Fluid Mechanics
- **Flow Induced Vibrations**
- Experimental Techniques

Relevant Applications:

- Aerospace
- **Wind Turbines**
- Power Engineering
- **Flow Control**

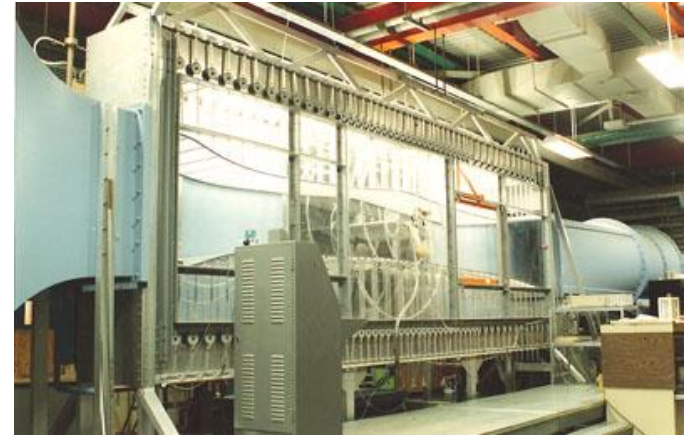
syarus@mecheng1.uwaterloo.ca



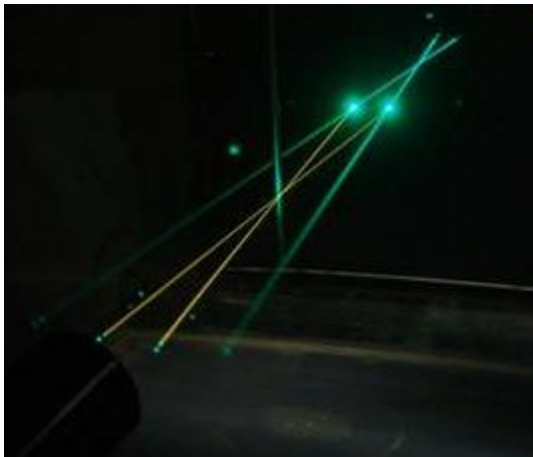
Fluid Mechanics Research Lab

Facilities

- Adaptive-wall wind tunnel
- Water tunnel
- State-of-the-art instrumentation



Wind Tunnel

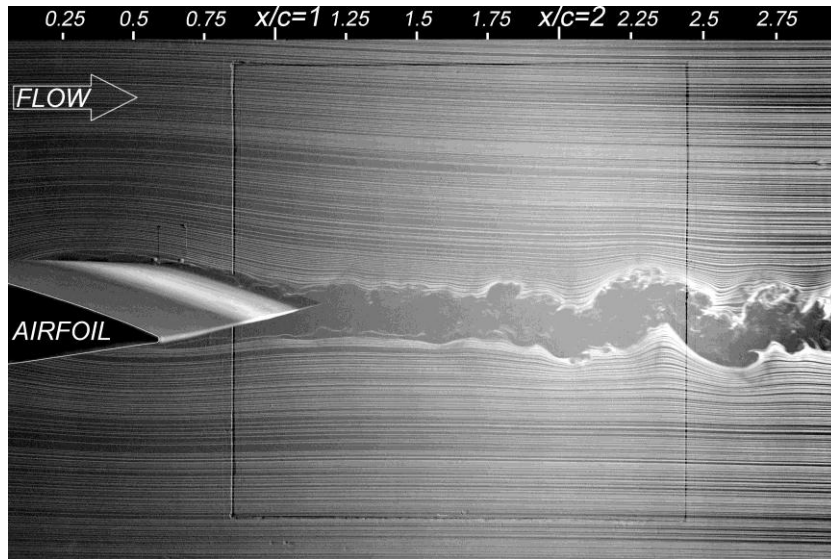


Water Tunnel

Fluid Mechanics Research Lab

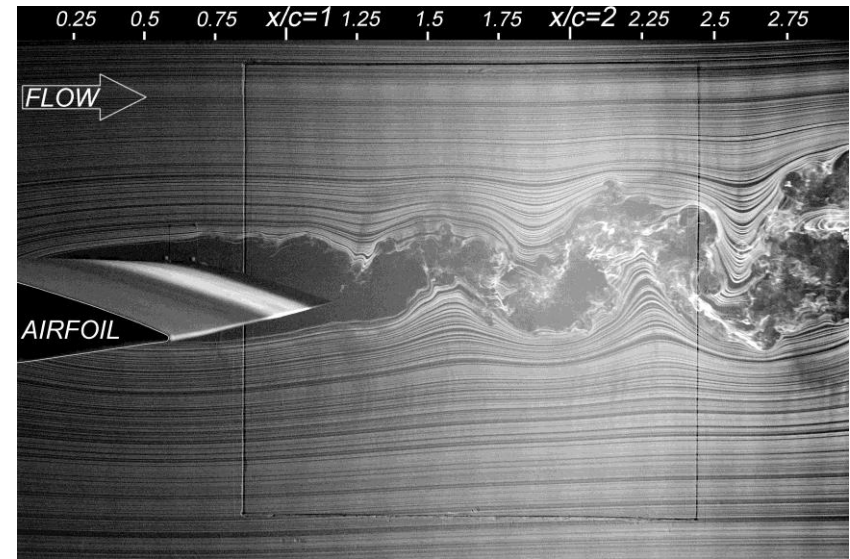
Sample Project: airfoil at low Reynolds numbers

Yarusevych et al., (2009), AIAA J.



Flow over an airfoil **at a high Re**
(**aerospace applications**)

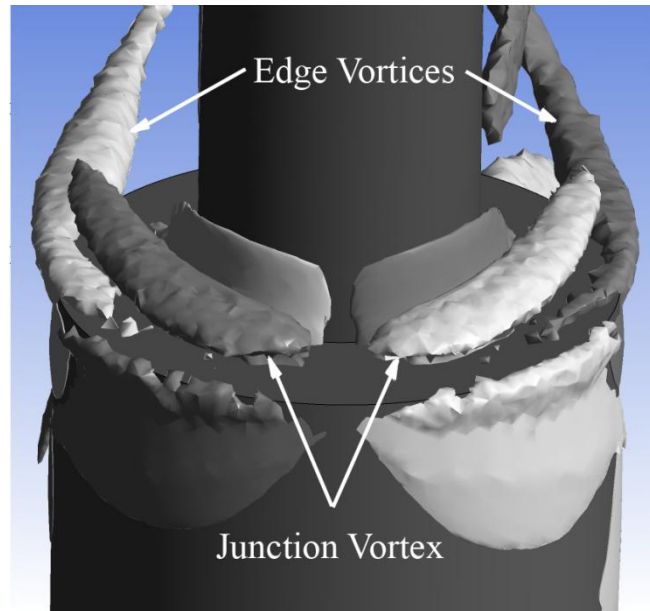
Yarusevych et al., (2009), AIAA J.



Flow over an airfoil **at a low Re** (e.g.,
blade of a small/medium **wind turbine**)

Fluid Mechanics Research Lab

Sample Projects: flow over a step cylinder



Morton, Yarusevych, Carvajal (2009)

Step cylinders are common in civil structures and heat exchangers. Flow over the step is governed by an intricate interaction of complex unsteady 3D structures and predicting flow characteristics is important for the engineering design.