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# Mechanical Engineering Tewksbury Seminar 2010

SEMINAR SERIES 2010

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MELBOURNE ENGINEERING  
RESEARCH INSTITUTE  
engineering research  
for the benefit of society

## Prof. Wolfgang Kollmann

Professor  
Mechanical & Aerospace Engineering Department  
University of California, Davis, USA

3pm Wednesday 10th November  
Mechanical Engineering Lecture Theatre  
Level 3, Building 170  
Mechanical Engineering  
Grattan Street

## Numerical Simulation of Vortex Ring Interactions.

An accurate numerical method is applied to the investigation of three flows generated by vortex tubes at Reynolds numbers  $1000 < Re < 3500$ .

(1) Vortex reconnection: Rogallo's Fourier spectral solver with a fourth order Runge-Kutta time integrator is used to simulate the interaction of orthogonal, off-set vortex straight tubes at  $Re=1500$ . The tubes are shown to reconnect and separate but remain linked with each other via a bridge formed by vortex sheets.

(2) Interaction of two co-axial vortex rings with the same sign of

circulation: The flow is generated by two co-rotating vortex rings with axial flow in opposite direction at  $Re=2000$ . The rings develop a strong wake with significant axial vorticity due to the stretching induced by the rings. The rings merge and form a single ring with complex internal structure.

(3) Interaction of two co-axial vortex rings with opposite sign of

circulation: The vortex ring collision flow is simulated for several Reynolds numbers  $O(Re)=2000$  using a hybrid spectral - finite difference solver with dynamic regridding. The results are shown to be in qualitative agreement with the experiments of T.B. Nickels.

*Professor Kollmann was born in Austria in 1942.*

*He received his university education in Germany: studying aircraft engineering in Stuttgart, graduating in 1967. He completed his PhD in Fluid Mechanics at RWTH Aachen in 1972.*

*He was a Post-doctoral fellow at The Johns Hopkins University from 1973-1975. an Assistant professor, at The von Karman Institute, Rhode-St.-Genese, Belgium, 1977-1981, and then an Assitant Professor/ Professor, MAE Department, University of California, Davis, USA, 1981 - 2010. He retired on 1st July 2010.*

### MORE INFORMATION

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