03-2 IUTAM Symposium on Integrated Modeling of Fully Coupled Fluid-Structure Interactions Rutgers, New Jersey, USA, June 02-06, 2003

a) Scientific Committee

P. Bearman (UK), H. Benaroya (USA, Co-Chair), E. Dowell (USA), H. Eckelmann (Germany), H.K. Moffatt (UK, IUTAM representative), P. Monkowitz (Switzerland), M. Païdoussis (Canada), J. Sheridan (Australia), T. Wei (USA, Co-Chair)

b) Short summary of scientific progress achieved

A large body of engineering and engineering science research and development involves fluid-structure interactions. Yet there are many unanswered questions about the underlying physics, so much so that a great deal of empiricism remains. Much of this empiricism can be traced to the relative lack of detailed collaboration between the fluid and structural mechanics communities studying these interactions. Yet, it appears that next-generation breakthroughs in the field can only come from fully coupled models in which the structure and the fluid are modeled at comparable levels of accuracy.

This Symposium, then, provided a forum for the latest thinking in analytical, computational and experimental modeling of structures interacting with fluid environments. The specific objective was to provide a structured format in which meaningful and lasting dialogues could be facilitated between leading researchers in the different component disciplines. And indeed, through these dialogues, multidisciplinary linkages were established leading to integrated approaches to modeling the complex, nonlinear interactions between fluids and structures. An indicator of the success of this Symposium was the formation of a university-industry collaboration involving computational modelers, experimentalists and applied mathematicians to provide science-based advanced to the design and analysis tools for off-shore oil platforms.

The opening invited lecture, by Dr. P. Palo set the tone for the five days of talks and discussions. Using current and future naval systems as a backdrop, he showed how technological advances in system design and analysis are critically tied to fundamental fluid-structure interaction science. Various aspects of this theme were reflected and expanded upon in subsequent invited lectures. Prof. E. Dowell examined non-linear structural dynamics issues while Prof. M. Païdoussis explored problems associated with axial flows. Prof. T. Sarpkaya provided an extensive overview of vortex-induced-vibration modeling. This was reinforced from an applied perspective by Prof. K. Vandiver using full-scale cable experiments. On the following day, Prof. J. Sheridan gave a more fundamental overview of the vortex dynamics associated with VIV and Prof. M. Triantafyllou discussed the problem of cables immersed in shear flows. Finally, Prof. P. Raad spoke on state-of-the-art Eulerian-Lagrangian techniques for modeling complex interfacial dynamics. These invited talks were complemented by over thirty submitted talks. Unfortunately due to the SARS crises, a number of papers from the Far East were withdrawn at the last minute.

c) Countries represented and number of participants

A total of 55 registered attendees from 12 countries participated in this Symposium:
Australia (3), Canada (4), India (2), Japan (1), S. Korea (1) Netherlands (1), Romania (1), Russia (1), Singapore (1), Turkey (2), UK (1), USA (37)

d) Publication of Proceedings of the Symposium

The proceedings will be published by Kluwer Academic Publishers in 2004 (editors: H. Benaroya and T. Wei)

e) Financial supports

The organizers gratefully acknowledge the following for their support of this Symposium:
- International Union of Theoretical and Applied Mechanics
- Kluwer Academic Publishers
- Office of Naval Research

• Rutgers, The State University of New Jersey

Support from IUTAM was used to support travel, registration and expenses for two participants from former Soviet block countries as well as to partially reimburse lodging for junior and international participants.

f) Scientific program

Day 1
Invited talk

P. Palo, *Survey of Naval Computational Needs in Fluid-Structure Interaction*

Oral presentations

F. Trarieux & G. J. Lyons, *Novel Use of a Bandwidth Measure for Vortex Induced Vibrations Case Study: The Foinaven Dynamic Umbilical*

B. I. Epureanu, *Chaotic Vibration-Based Damage Detection in Fluid-Structural Systems*

S. Han & M. Grosenbaugh, *Comparison of Two Seafloor Observatory Mooring Designs*

Invited talk

E. Dowell & D. M. Tang, *Nonlinear Dynamics of Very High Dimensional Fluid-Structural Systems*

Oral presentations

J. M. Jiménez, J. H. J. Buchholz, A. E. Staples, J. J. Allen & A. J. Smits, *Flapping Membranes for Thrust Production*

J. Carberry, K. Ryan & J. Sheridan, *Experimental Study of a Tethered Cylinder in a Free Stream*

K. Ryan, M. C. Thompson & K. Hourigan, *The Effect of Changed Mass Ratio on the Motion of a Tethered Cylinder*

S. Srigrarom & M. Kurosaka, *Self-excited Oscillation of Equilateral Triangular Wedge*

Day 2

Invited talk

T. Sarpkaya, *A Critical Review of the Intrinsic Nature of VIV*

Oral presentations
S.Kocabiyik & Q. Al-Mdallal, *A Numerical Study on the Rectilinear Oscillations of a Circular Cylinder*
Y. Liu, R. M. C. So & C. Zhang, *Three-Dimensional Modeling of Flow-Induced Vibration for an Elastic Cylinder in a Cross Flow*
D. Lucor, J. Foo & G. E. Karniadakis, *Correlation Length and Force Phasing of a Rigid Cylinder Subject to VIV*
D. Rockwell, M. Ozgoren & N. Saelim, *Self-Excited Oscillations of Vertical and Horizontal Cylinders in Presence of a Free-Surface*

Invited talk
J. K. Vandiver & H. Marcollo, *High Mode Number VIV Experiments*

Oral presentation
Y. Modarres-Sadeghi, M. P. Païdoussis, C. Semler & P. Picot, *Nonlinear Dynamics of Slender Cylinders Supported at Both Ends and Subjected to Axial Flow*

Day 3

Invited talk
M. P. Païdoussis & T. Workman, *Some Quandaries and Paradoxes in Fluid-Structure Interactions with Axial Flow*

Oral presentations
M. M. Zhang, L. Cheng, Y. Zhou, *Closed-Loop Control of the Resonant Flow-Structure Interaction Using PID Controllers*
K.Y. Billah, O. Ahmad, *Vortex-Induced Vibration Structural Response under Parametric Excitation*
R. Govardham & C. H. K. Williamson, *Frequency Response and the Existence of a Critical Mass for an Elastically-Mounted Cylinder*
C. M. Leong, H. Benaroya & T. Wei, *Two-Degree of Freedom VIV of a Circular Cylinder Pinned at One End*

Invited talk
M. S. Triantafyllou, F. S. Hover, A. H. Techet & D. K. P. Yue, *Vortex-Induced Vibrations of Slender Structures in Shear Flow: A Review*

Oral presentations

J. B. Frandsen, *A Tuned Liquid Damper Model*

K. Fujita & A. Shintani, *Unstable Phenomena of a Thin Cylindrical Shell Subjected to Axial Leakage Flow*

A. Norris, *Acoustic Scattering from a Coated Elastic Shell: Exact Vs. Approximate Theory*

E. Gavrilova, *A Study of the Vibration of Fluid Coupled Coaxial Cylindrical Shell*

K. N. Karagiozis, M. P. Païdoussis, E. Grinevich, A. K. Misra &M. Amabili, *Stability and Non-Linear Dynamics of Clamped Circular Cylindrical Shells in Contact with Flowing Fluid*

K. Dempsey & I. Vasileva, *Forced Dynamic Uplift of Floating Plates*

Day 4

Invited talks

J. Sheridan, *Vortex Shedding from Oscillating Cylinders*

R. Bidoae, R.M. Ciobotaru & P.E. Raad, *An Eulerian-Lagrangian Marker and Micro-Cell Simultation Method for Fluid Interaction with Solid/Porous Bodies*

Oral presentations

S. Siegel, K. Cohen & T. McLaughlin, *Low-Dimensional Feedback Control of the von Karman Vortex Street at a Reynolds Number of 100*

M. S. Fofana & Z. Hou, *Stochastic Bifurcations of the Duffing-Mathieu Equations with Time Delays*

Z. Guo & Y. Zhou, *Numerical and Experimental Investigation of a Streamwise Oscillating Cylinder Wake in the Presence of a Downstream Cylinder*

S. A. Isaev & Z. L. Zhdanov, *Control of Cylinder Drag and Lift Force Amplitude in Turbulent Crossflow*

F. Cirak & R. Radovitzky, *A New Lagrangian-Eulerian Shell-Fluid Coupling Algorithm Based on Level Sets*

S. van Zuijlen & H. Bijl, *Application of Higher Order Runge-Kutta Time Integrators in Partitioned Fluid-Structure Interaction Simulations*

Day 5

Oral presentations

S. Bhattacharyya, D. K. Maiti, *Vortex Shedding for Flow Over a Square Cylinder Close to a Moving Ground*

H. Benaroya, T. Wei, *Extended Hamilton's Principle for Fluid-Structure Interaction*

M. Krane, P. Dong, T. Wei, *Estimation of Pressure Fields Using Velocity Measurements*

S. Gökaltun, H. Saygin, M. Muradolu, *Implicit Multigrid Computations of Unsteady Multiphase Flows in Varying Cross-Sectional Area Channels*

M. S. Fofana, Y. Yong, *Dynamic Stability of Stochastic Delay Systems*

Report composed by Timothy Wei