EUROMECH Final report

EUROPEAN MECHANICS SOCIETY

EUROMECH COLLOQUIUM N°374

Title:	"Recent Computational Developments in Steady and Unsteady Naval Hydrodynamics"
Date and location:	27-29 APRIL, 1998 ENSMA-Université de POITIERS (FRANCE)
Chairman:	Michel GUILBAUD (University of Poitiers)
Co-Chairman:	Gérard Delhommeau (Ecole Centrale de Nantes)

Full registration fee:	1550F.
Others funding:	Conseil Régional, Conseil Général, Délégation Générale à l'Armement (Ministry of Defense), Association Universitaire de Mécanique, University of Poitiers, Faculty of Sciences of Poitiers, Centre d'Etudes Aérodynamiques et Thermiques, Ecole Nationale Supérieure of Mécanique et Aérotechnique (no funds but free rooms for the Colloquium).
What were the participants offered:	lunches and coffee-breaks (morning and afternoon) during the 3 days, banquet with musical animation, preliminary and final proceedings (310 pages), case with technical and tourist information.

Number of members of Euromech (reduced registration fee):	2 (paid separately)
Number of non-members of Euromech (full registration fee):	38

Number of participants from each countries:

France:	22,	**Poland:**	1,
Germany:	5,	**Russia:**	2,
Great-Britain:	4,	**Turquie:**	1,
Italy:	1,	**United States :**	1.
Netherlands:	3,		

Scientific report

The 374th Colloquium took place on the new site of Futuroscope, in the modern building of the Ecole Nationale Supérieure de Mécanique et Aérotechnique, close to Poitiers, from April 27th-29th April, 1998. There were 40 participants from 9 countries. There were one invited conference, by Professor Volker Bertram from Technical University Hamburg-Harburg (Germany), "Marching towards the numerical ship model basin". During this presentation, Professor V.Bertram made a full up to date panel on the possibilities and limitations of the computational fluid dynamics in Naval Hydrodynamics, both for viscous (without gravity waves) or inviscid flows, particularly concerning the seakeeping. There were also 25 others contributions.

The proceedings and the sessions have been divided into 5 distinct topics:

1. Coupling methods (3 papers):
    - viscous effect correction of a slender body theory; coupling between 2D Navier-Stokes equation with an outer vortex method around a submerged cylinder; coupling of a 3D panel method with a resolution of the Navier-Stokes equations in the near field;
2. Time-domain and non linear problems (7 papers):
    - second-order time domain boundary integral equation method; large amplitude ship motions (body condition on the exact location but linear free-surface condition); second-order wave drift force in time domain, computations of the time domain Green's function using a differential equation; interaction of a steady ship wave pattern with an incoming wave; a complete time domain non linear wave pattern; use of a pseudo-spectral sigma transformed potential flow model to study the non linear interaction of steep waves with obstacles;
3. Resolution of Navier Stokes equations (6 papers):
    - simulations of the loads due to an inland vessel on the ground of a river, with and without propeller, using the Reynolds averaged Navier-Stokes equations; a cell centered finite volume method to solve the time 2D laminar incompressible Navier-Stokes equations with use of an artificial compressibility under a free-surface; turbulent flow around a ship rudder using a 2D Reynolds averaged Navier-Stokes equations; air and water flows computed by a finite volume method with unstructured meshes and interface capturing scheme to determine the shape of the free-surface; DNS computations (low Reynolds number) and k-ε model (Reynolds number) around a submerged ellipsoid; volume of fluid method for the bow flare slamming on a free surface;
4. Frequency domain (6 papers):
    - a Rankine panel method for the computations of the seakeeping of a ship in oblique waves; Green's functions and super Green's functions (corresponding to the distribution on a curved hull panels or waterline segment instead of point singularities for the Green's functions) to develop a Kelvin singularities based free-surface computations (steady flow or diffraction radiation without forward speed); comparison of numerical computations with a seakeeping code using the diffraction radiation with forward speed Green's function with test on ship models in forced heave and pitch oscillations (forces and unsteady wave patterns); study of ship motions in regular waves by a Rankine source panel method with different types of linearisation (with respect to the undisturbed onset flow or a double model); a vortex lattice method using the diffraction radiation with forward speed Green's function for a flat plate in forced sway or yaw motions; the second order wave radiation by an oscillating axisymmetric cylinder studied by a hybrid numerical and analytical method in finite water depth;
5. Steady flows and miscellaneous (3 papers):
    - a comparative criterion to optimise a ship hull based on a new form of the Michell integral to obtain the least wave resistance; the study of the accuracy of the boundary integrations in a steady panel method using the diffraction radiation with forward speed Green's function; study of the interfacial waves due to a moving cylinder in a two layer fluid using an exact body condition and a linear free-surface one.

A full set of proceedings with 310 pages has been edited.

The informal atmosphere and the limited number of participants have led to fruitful contacts and quite interesting discussions between the various researchers at the end of the presentations, but also during the various coffee breaks, the meals and the banquet. During this last one, a musical atmosphere has been offered to the participants.

It will be noticed that thanks to the sponsors and more particularly the local ones (Conseil régional Poitou-Charentes and Conseil Général de la Vienne) extra subventions have been given to 2 russian professors (no charge for the Congress and hotels, trains and meals paid in France) and to 6 researchers under 35, instead of only 3 paid by the Euromech Committee.

Poitiers, the 15th of July, 1998

M.GUILBAUD