Report on:

EUROMECH COLLOQUIUM 273

UNILATERAL CONTACT AND DRY FRICTION

La Grande Motte, France, May 29th-june 1st 1990.

Scientific Contents.

The Colloquium theme was the evolution of deformable or rigid bodies submitted to unilateral contact, in quasi-static or dynamic situations. Friction at contact points had to be of the "dry" sort, so lubrication problems did not belong to the scope.

The *Physics of Friction* was not explicitely mentioned in the call for communications. However the organizers have thought it beneficial to invite a specialist to present a communication entirely devoted to experimental aspects. At the theoretical level, another communication developed the thermodynamical formalization of frictional contact.

The dynamical behaviour of constructions submitted to *earthquakes* was treated by three different groups of Italian participants. This also was the object of microcomputer simulations presented by the inviting laboratory. The matter involves dynamical problems with possible collisions. A communication by a Portuguese participant presented existence theorems for problems of this sort.

Damping through dry friction, with possible "stick-slip", is also a dynamical question; it was treated in a communication devoted to the case of turbine blades.

Applications to *Robotics* made the subject of two communications: unilaterality of contact and dry friction in manipulators.

The *buckling* of elastic structures submitted to frictional unilateral contact was the subject of one talk.

The numerous communications devoted to *continuous systems* were nearly always restricted to *quasi-static evolutions*. With the exception of two authors, one of them using series expansions and the other a Green function technique, the finite element methods were dominant. This allows for a wide diversity in numerical treatments. The mathematical analysis of the existence of solutions or the convergence of algorithms has been approached, but most communications aimed at specific applications, among which:

a. Deep drawing, rolling (in particular with multilayered materials), indentation.

b. Cracking and evolution of cracked media.

c. Biomechanics: articulations and prostheses.

Organisation.

Calm surrounding for lodging and sessions was provided in the holiday complex "Village Vacances Familles", La Grande Motte, not crowded at that time. Adjacent to the well equipped conference hall, a smaller room contained a choice of microcomputers for demonstrations or informal discussions. Touristic activity was reduced to a late afternoon trip to the mediaeval city of Aigues-Mortes, followed by a banquet in a wine cellar. Bus transportation for an after-dinner walk through Montpellier was provided on the following day.

In addition to the registration fee paid by participants, funding has been obtained from various sources, listed in the booklet of "Abstracts of Communications". This has allowed the organisers to support the accomodation charge and registration fee of a certain number of participants, namely those coming from Eastern Countries, some young scientists and the members of the International Committee.

The enclosed List of Participants goes to a total of 64, coming from 16 countries (24 came from France). Non-Europeans were only 3 from China, currently working in Germany, France and Switzerland, respectively. In spite of our offer to take their accomodation charge and registration fee on our account, several invited participants from Eastern Countries, including USSR, have been unable to come.

Conclusion.

The organizers deem that the objective of a geographic meeting of Scientists whose current research programs involve contact unilaterality and dry friction has been reasonably well attained. For a number of participants, the everyday concern is with *metal forming*. On this purpose, several research center are currently developing computation codes of industrial size, taking the said effects into account. The publications made by the authors of these codes do not generally allow one to appreciate the technical difficulties and the possible advantage of one approach against another. This Euromech has provided the occasion of direct discussion.

Research on the effects of earthquakes is particularly active in European mediterranean countries. The Colloquium has improved the communication between diverse groups active on this subject. Above all, it has been made clear to everyone that the treatment of *dynamical problems*, involving unilaterality and dry friction, is now quite feasible. This opens the way to numerous other applications.

The organizers are grateful to the European Mechanics Committee for having granted this meeting the label of *Euromech Colloquium*.

Montpellier, July 10. 1990.

J. J. Moreau, Chairman.

Euromech 273
Unilateral Contact and Dry Friction.
La Grande Motte, France, May 29th-June 1st, 1990
List of Participants.

Prof. S. CESCOTTO	LIEGE	BELGIUM
Dr. R. CHARLIER	LIEGE	BELGIUM
Dr. G. DE SAXCE	MONS	BELGIUM
Dr. A. B. RICHELSEN	LYNGBY	DENMARK
Prof. H. PARLAND	ESPOO	FINLAND
Dr. P. ALART	GRENOBLE	FRANCE
Dr. F. AXISA	GIF sur YVETTE	FRANCE
Prof. G. BAYADA	LYON	FRANCE
Prof. Y. BERTHIER	LYON	FRANCE
Dr. G. CARACCI	TOULOUSE	FRANCE
Dr. P. CHABRAND	MARSEILLE	FRANCE
Dr. M. CHAMBAT	LYON	FRANCE
Dr. X. CHATEAU	MONTATAIRE	FRANCE
Dr. T. CHATOR	CHATOU	FRANCE
Dr. F. COLIN	LYON	FRANCE
Dr. M.-C. DUBOURG	LYON	FRANCE
Dr. J. DUFFAUD	BESANCON	FRANCE
Mr. D. DURVILLE	CHATENAY-MALABRY	FRANCE
Dr. M. L. EDLINGER	VALBONNE	FRANCE
Dr. D. FORTUNE	POITIERS	FRANCE
Mr. F. HORKAY	BILLANCOURT	FRANCE
Dr. G. JACQUART	CLAMART	FRANCE
Dr. M. JEAN	MONTPELLIER	FRANCE

Dr. C. LICHT	MONTPELLIER	FRANCE
Prof. J. J. MOREAU	MONTPELLIER	FRANCE
Dr. NGUYEN QUOC SON	PALAISEAU	FRANCE
Dr. E. PRATT	MARSEILLE	FRANCE
Dr. M. RAOUS	MARSEILLE	FRANCE
Prof. G. TOUZOT	COMPIEGNE	FRANCE
Dr. Zhi-Qiang FENG	COMPIEGNE	FRANCE (orig. CHINA)
Prof. Dr. Ing. H. BUFLER	STUTTGART	GERMANY
Dipl.-Ing. C. GLOCKER	MÜNCHEN	GERMANY
Dr. J. GWINNER	DARMSTADT	GERMANY
Mr. J. JAEGER	KARLSRUHE	GERMANY
Dr. H. ROTHERT	HANNOVER	GERMANY
Mr. G. WANG	BERLIN	GERMANY (orig. CHINA)
Dr. C. BISBOS	THESSALONIKI	GREECE
Dr. J. DOUDOUMIS	THESSALONIKI	GREECE
Prof. P. D. PANAGIOTOPOULOS	THESSALONIKI	GREECE
Prof. A. BRESSAN	PADOVA	ITALY
Prof. G. DEL PIERO	UDINE	ITALY
Dr. R. LUCIANO	ROMA	ITALY
Prof. F. MACERI	ROMA	ITALY
Dr. A. MONTANARO	PADOVA	ITALY
Dr. Elio SACCO	ROMA	ITALY
Prof. A. SINOPOLI	VENICE	ITALY
Mr. G. ZAVARISE	PADOVA	ITALY
Dr. G. F. M. BRAAT	DORDRECHT	NETHERLAND
Prof. J. J KALKER	DELFT	NETHERLAND
Dr. A. ZMITROWICZ	GDANSK	POLAND
Dr. M. D. P. MONTEIRO MARQUES	LISBON	PORTUGAL
Prof. J. A. C. MARTINS	LISBON	PORTUGAL
Prof. E. PIRES	LISBON	PORTUGAL

Dr. M. COCU	BUCHAREST	RUMANIA
Dr. L.-E. ANDERSSON	LINKÖPING	SWEDEN
Mr. Lars JOHANSSON	LINKÖPING	SWEDEN
Dr. A. KLARBRING	LINKÖPING	SWEDEN
Dr. A. CURNIER	LAUSANNE	SWITZERLAND
Mr. E. HEEGAARD	ECUBLENS	SWITZERLAND
Dr. Qi-Chang HE	LAUSANNE	SWITZERLAND (orig. CHINA)
Dr. J. A. GREENWOOD	CAMBRIDGE	UNITED KINGDOM
Dr. D. NOWELL	OXFORD	UNITED KINGDOM
Prof. D. SPENCE	LONDRE	UNITED KINGDOM
Dr. A. MIKELIC	ZAGREB	YUGOSLAVIA