

Please send this report to the Secretary of the European Mechanics Council, Professor Bengt Lundberg, Dept of Mechanical Engineering, Luleå University of Technology, S-951 87 Luleå, Sweden, one month after the Colloquium

### General

Euromech Colloquium No: 277

Title: Micromechanical Models for Strength and Fatigue of Polymer Based Fibre Composites

Chairmen: Peter Gudmundson, Ramesh Talreja

Place and country: Swedish Institute of Composites, Piteå, Sweden

Dates: June 13-15, 1991

### Finance

The conference fee 1500 SEK included VAT 300

Funding: One dinner from the city of Piteå

Accommodation (type and cost): Youth Hostel 175 SEK and Hotels

Meals: All meals included in conference fee

### Participation

Total number of participants: 41

Distribution of participants by country:

Code	Country	Number	Code	Country	Number
	Austria	<u>      </u>	I	Italy	<u>  1  </u>
B	Belgium	<u>      </u>	IRL	Ireland	<u>      </u>
BG	Bulgaria	<u>      </u>	N	Norway	<u>      </u>
CH	Switzerland	<u>  3  </u>	NL	Netherlands	<u>  1  </u>
CS	Czechoslovakia	<u>      </u>	P	Portugal	<u>      </u>
D	Germany	<u>  2  </u>	PL	Poland	<u>  1  </u>
DK	Denmark	<u>  5  </u>	R	Rumania	<u>      </u>
E	Spain	<u>      </u>	S	Sweden	<u> 19  </u>
F	France	<u>  4  </u>	SF	Finland	<u>  1  </u>
GB	Great Britain	<u>      </u>	YU	Yugoslavia	<u>      </u>
GR	Greece	<u>      </u>	SU	Soviet Union	<u>  1  </u>
H	Hungary	<u>      </u>	-	Others	<u>  3  </u>

Is there need of another colloquium on the same subject? Which year? YES 1993

# Scientific Report

## Euromech Colloquium 277 Micromechanical Models for Strength and Fatigue of Polymer Based Fibre Composites

The first day of the meeting was devoted to aspects on strength and fatigue of composites. Professor Ken Reifsnider presented current work on micromechanical models for prediction of fatigue characteristics. In particular a new method for measurement of interface strength was explained. Professor Tamusz showed us recent results on statistical aspects of strength of unidirectional laminates. Micromechanical models for compressive strength were discussed by professor Tom Hahn. A model for the influence of fibre/matrix interface on toughness was presented by Henrik Albertsen. Professor Landriani discussed a micromechanical model for plastic deformation of the matrix material. Current work on simulations of delamination growth was presented by Karl-Fredrik Nilsson. The discussion at the end of the first day was focused on the validity of the energy release rate approach for modelling of delamination growth and microcrack formations.

The second day of the Colloquium was concentrated on modelling of matrix microcracking and damage mechanics applied to composite materials. Professor Talreja gave an overview on different theoretical models for the simulation of the effects of microcracks on mechanical parameters. Five presentations (Varna, Gudmundson, Östlund, Mårtensson, Pyrz) were then describing different models for matrix microcracking and local delaminations. Different aspects were treated such as: prediction of changes in the stiffness tensor, changes in the thermal expansion tensor, strain due to release of residual stresses. Some presentations were also dealing with models for microcrack evolution. Dr Andersen showed experimental results on microcrack evolution in laminates with different levels of residual stresses. The two last presentations of the day dealt with application of damage mechanics to composite laminates (Perreux, Frund). The final discussion was focused on the applicability of damage mechanics to composites.

The third day included three presentations. Kay Brockmüller presented FE results for micromechanical stresses and strains in short fibre composites with the intention to develop models for stiffness and strength. John Thesken showed experimental results on dynamic delamination growth and corresponding theoretical evaluations. The last presentation was given by Nils Svanstedt, who discussed the mathematical theory of homogenization in application to composite materials.

In conclusion the Euromech Colloquium was successful. Each presentation gave rise to several discussions. Also in the general discussion sessions most of the participants were active.