

Characterization of microphenomena in composite materials

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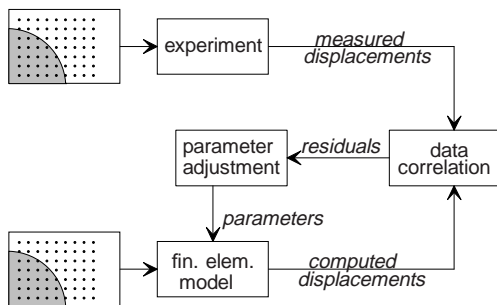
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INTRODUCTION

- ◇ numerical-experimental method
- ◇ field quantities: displacements
- ◇ transversely loaded composites
- ◇ parameter estimation

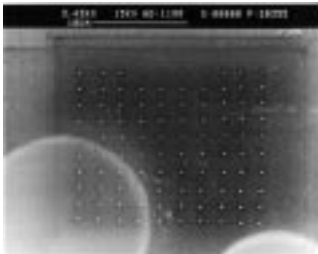
PARAMETER ESTIMATION



DISPLACEMENT MARKERS

Markers created by the electron beam of a SEM:

- 1) raised dots on surface of specimen:



- 2) black spots on surface of specimen:



→ experiments in SEM

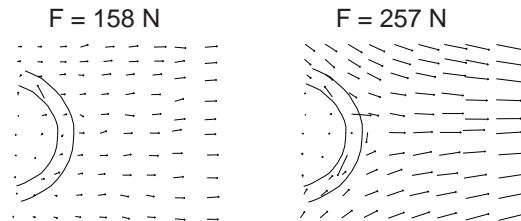
Microphenomena:

- ◇ fibre coatings
- ◇ interphase conditions
- ◇ interfacial normal strength

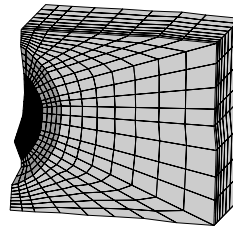
FIBRE COATINGS

- ◇ single fibre model composites
- ◇ uncoated and coated fibres ($E_c = 0.5 * E_m$)

Displacements ($\times 5$):



Finite Element Modelling



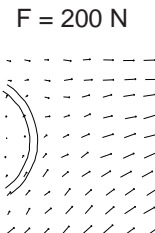
- parameter: E_c
 coating: $2 \mu\text{m}$
 ◇ geometry:
 marker coordinates
 ◇ bound. cond.:
 measured displacements

Parameter Estimations:

average values: $\hat{E}_{unc} = 0.6 \text{ GPa}$, $\hat{E}_c = 0.2 \text{ GPa}$

INTERPHASE CONDITIONS

- ◇ parameter: E_i
- ◇ high V_f composites
- ◇ interphase: $1 \mu\text{m}$
- ◇ isotropic

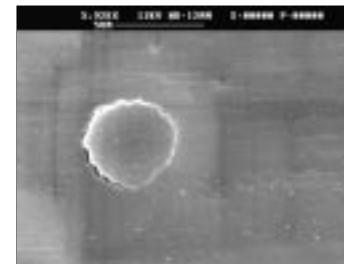


Parameter Estimations:

average value: $\hat{E}_i = 0.5 \text{ GPa}$

INTERFACIAL NORMAL STRENGTH

- ◇ C-Fibre: surface treatment 0-200%
- ◇ stress state at debonding gives INS:



CONCLUSION

- ◇ method is suitable for identification of microphenomena