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Characterization of Microphenomena in Composite Materials

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INTRODUCTION

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

PARAMETER ESTIMATION

[Diagram: experiment → measured displacements → parameter adjustment → residuals → computed displacements]

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 ($E_c = 0.5E_m$)

Displacements ($\times 5$):

- $F = 158$ N
- $F = 257$ N

Finite Element Modelling

Parameter Estimations:

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

INTERPHASE CONDITIONS

- parameter: $E_i$
- high $V_f$ composites
- interphase: 1 $\mu$m
- isotropic

Parameter Estimations:

- average value: $\bar{E}_i = 0.5$ GPa

INTERFACIAL NORMAL STRENGTH

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

CONCLUSION

- method is suitable for identification of microphenomena