

## BIAXIALITY, PHASE TRANSITIONS AND SYMMETRY

Equilibrium states (phases) of liquid crystals are characteristically modelled as critical points of a free energy function defined on a suitable space of order parameters. To capture biaxial as well as uniaxial phases the order parameters in principle belong to the 25-dimensional space of linear transformations of  $V$ , where  $V$  is the 5-dimensional space of  $3 \times 3$  real traceless symmetric matrices. A common simplifying assumption reduces this dimension from 25 to four. Using invariant theory and singularity theory methods we give a full analysis of the bifurcation (i.e. phase transition) behaviour close to isotropy determined by any free energy function of the four order parameters having appropriate symmetry. The symmetry group itself exhibits interesting structure not always evident from the literature.