1023-35-1517 **A Majumdar**, **JM Robbins** and **Maxim Zyskin*** (`zyskin@yahoo.com`), Department of Mathematics, University of Oxford, Oxford, OX1 3LB, England. *Nematic liquid crystals and harmonic maps on polyhedral domains: theory and applications.*

States of nematic liquid crystal in polyhedral cells are described by director fields (maps to RP^2) minimizing the Frank energy, subject to tangent (periodic, normal) boundary conditions on faces. In the 1-constant approximation, minimising configurations are harmonic maps. Tangent boundary conditions disallow continuity at vertices. We investigate regular solutions, which are continuous away from the vertices. Topological classes of regular configurations are classified by topological invariants associated to edges, pairs of edges with a common vertex, and vertices. For tangent boundary conditions, we establish lower energy bounds in terms of the invariants, and for a a rectangular prism the matching upper bounds. Analytic and numerical evidence suggests that on a rectangular prism there are topologically nontrivial regular solutions which exist for a certain range of aspect ratios of the prism, but become singular otherwise. For periodic array of rectangular posts, important in applications, there exists several topologically inequivalent regular configurations. Our work has applications to new bistable displays, where unlike the traditional displays external voltage is only required to switch pixels, but not to maintain a static picture. (Received September 26, 2006)