Energy-variational solutions and their approximation

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In this talk, energy-variational (EnVar) solutions are introduced for a large class of nonlinear evolution equations. Considering the Ericksen–Leslie equations modelling the evolution of liquid crystals, we observe that EnVar solutions emerge as the limit of a structure-preserving finite element scheme. We can show weak-strong uniqueness of the limit solution and additionally the so-called semi-flow property, which says that concatenations and restrictions of EnVar solutions are EnVar solutions again. Under certain assumptions every EnVar solution implies the existence of a measure-valued solution to the Ericksen–Leslie system. This implies that the EnVar solution concept is finer than the usual measure-valued solution concept. Finally, a time-discretization scheme is introduced via an incremental minimization, which resembles the minimizing movement scheme for gradient flows.