

In this thesis, we explore classes of mappings suitable for models in Nonlinear Elasticity. We investigate whether, given the presence of certain desirable properties, there exists an element within the class that exhibits pathological behaviour. In the presented papers, we primarily focus on subclasses of Sobolev mappings, particularly weak closures of homeomorphisms with additional properties. These properties typically manifest themselves in the form of an additional term in the energy functional.

We show that weak limits of Sobolev homeomorphisms in $W^{1,n-1}$ satisfy the so-called *(INV)* condition if the integrability of the reciprocals of the Jacobians is sufficiently high. This result is sharp and we present a counterexample for cases of lower integrability. The *(INV)* condition is also preserved under weak limits when we add a term dependent on the cofactor matrix of the derivative, as its integrability provides some regularity for the inverses of the homeomorphisms in the sequence. Furthermore, we show that assumptions on regularity of the inverses can also ensure a.e. differentiability of the limit.

Other topics investigated in this thesis include the sizes of critical sets violating the Luzin *(N)* condition in the case of Sobolev homeomorphisms and the (dis)continuity of mappings of generalized distortion, where we present both positive results and counterexamples in the planar case.