From Morse Theory on Finite Dimensions to Floer Theory for Minimal Surfaces

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In this talk about my master thesis, we outline the methodology for determining the CW-decomposition of Sobolev spaces through the Morse theory of the energy functional. We examine the resulting information about the harmonic maps, including stability and indices as determined by the Jacobi operator. Additionally, we address obstacles to CW decomposition and review recent research aimed at overcoming challenges with these spaces. As the main challenge is that the CW decomposition cannot be determined through Morse theory, further analysis of the Jacobi operator may be pursued by adopting a Floer-theoretic perspective on harmonic maps from the torus to Kähler manifolds. This approach follows the theory of Oliver Fabert and Ronen Brilleslijper on polysymplectic geometry and the CRPS action functional, which generalizes symplectic geometry. With this, we aim to formulate a relation between the Morse index and the Conley-Zehnder index for minimal surfaces, as was done for geodesics through the symplectic action functional.