The Nitsche Phenomenon for Weighted Dirichlet Energy

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The talk is based on the joint work with T. Iwaniec and J. Onninen

The present paper arose from recent studies of energy-minimal deformations of planar domains. We are concerned with the Dirichlet energy. In general the minimal mappings need not be homeomorphisms. In fact a part of the domain near its boundary may collaps into the boundary of the target domain. In mathematical models of nonlinear elasticity this is interpreted as *interpenetration of matter*. We call such occurrence the *Nitsche phenomenon*, after Nitsche's remarkable conjecture (now a theorem) about existence of harmonic homeomorphisms between annuli. Indeed the round annuli proved to be perfect choices to grasp the nuances of the problem. Several papers are devoted to a study of deformations of annuli. Because of rotational symmetry the Dirichlet energy-minimal deformations turned out to be radial maps. That is why we confine ourselves to radial minimal mappings. The novelty lies in the presence of a weight in the Dirichlet integral. We observe the Nitsche phenomenon in this case as well. However, the arguments require further considerations and ne w ingredients. One must overcome the inherent difficulties arising from discontinuity of the weight. The Lagrange-Euler equation is unavailable, because the outer variation violates the principle of none interpenetration of matter. Inner variation, on the other hand, leads to an equation that involves the derivative of the weight. But our weight function is only measurable which is the main challenge of the present paper.