

TOPICS IN GEOMETRIC ANALYSIS WITH APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS

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ABSTRACT

The main aim of the current thesis is to investigate the mathematical tools and methods used to study problems which bridge between analysis and geometry. Such an undertaking is particularly useful in situations in which the geometry is variable, such as:

- the theory of minimal surfaces, in differential geometry
- shape analysis and optimization
- engineering modeling
- continuum mechanics (elasticity phenomena for beams, plates, shells, etc)
- free or moving boundary problems
- certain variational problems in partial differential equations

A common feature of the above circumstances is that the underlying geometry is the variable one wishes to study. From a historical point of view, the basic principles and methods employed in the treatment of such problems originated in rather distinct fields of applied and theoretical mathematics, and have traditionally evolved on distinct, parallel paths. Our ultimate goal is to provide alternative, conceptually simpler approaches to some of the basic results in these fields.