1139-58-679 **P. Robert Kotiuga*** (`prk@bu.edu`), 8 Saint Mary's Street, Boston, MA 02215. *Nonlinear Conformally-invariant First-order Elliptic Systems in Three Dimensions: A variational perspective with and applications to geometric inverse problems.* Preliminary report.

The Laplace-Beltrami operator acting on middle degree forms of an even dimensional manifold is conformally invariant. In 2-D this relates to conformal invariance in complex analysis. In 4-D this relates to the conformal invariance of Maxwell's equations and Yang-Mills equations. Unfortunately, there's no "middle dimension" in odd dimensions, and no analogous conformally invariant geometric differential operators. However, they have a pair of middle dimensions and is particularly interesting in 4k-1 dimensions .

In this paper we develop a variational formulation of a conformally invariant 1^{st}-order elliptic system in 3-D which is necessarily nonlinear. It has a connection to:

- Arnold's work on the mean asymptotic linking number of a flow and its relation to the helicity of a flow.
- Freedman and He's use of the conformal modulus in bounding the mean asymptotic crossing number of a flow.
- Kotiuga's use of the Giroux correspondence in order to characterize the topology of near force-free magnetic fields.
- Adrian Nachman's use of minimal surface theory in the context of impedance tomography; an inverse problem where a Riemannian metric is determined within its conformal class.

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