1077-18-2400 **P. Robert Kotiuga*** (prk@bu.edu), Boston University, ECE Dept., 8 Saint Mary's Street, Boston, MA 02215. *Generalized Cohomology Theories in Engineering Practice.* Preliminary report.

Consider examples and interrelationships through the interrelationships between the generalized cohomology theories illustrated:

- In computational electromagnetics, a simplicial complex is a finite element mesh, and the variational formulation of Hodge theory on manifolds with boundary leads to the use of Whitney forms as a direct variational method.
- Pontryagin's proof of the existence of Seifert surfaces lead to Oriented Bordism Theory. In computational electromagnetics it is the basis for computing "cuts for magnetic scalar potentials".
- Equivariant cohomology identifies "stationary phase approximations" which are exact.
- K-theory is used in materials science(topological insulators, topological superconductors, quantum Hall effect) and communication engineering: The "vector fields on sphere problem", and normed division algebras, are key to MIMO information theory; construction of expander graphs are key to both coding theory and counterexamples to the Baum-Connes conjecture with coefficients.

These (generalized) cohomology theories are related through calculus and PDEs. The one-liner: "there exists a spectral sequence…" sums up the algebra, but also opens a door to a unified view of algorithmic complexity. (Received September 22, 2011)