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Mark E Fels* (mark.fels@usu.edu), Department of Mathematics and Statistics, Utah State University, Old Main Hill, Logan, UT 84321. *The Generalized Inverse Problem in the Calculus of Variations and Bi-Hamiltonian Systems.*

Associated to every system of evolution equations $u_t^i = f^i(t, x, u, u_x, \dots, u_n)$ is its corresponding variational bi-complex. A particular component of the cohomology of this bi-complex can detect, in an invariant manner, the variational nature of the equation. I will show how this occurs, and apply this theory to compatible bi-Hamiltonian systems. (Received August 27, 2016)