Symbolic computation of conservation laws of PDEs in (3+1)-Dimensions

A new algorithm will be presented for the symbolic computation of conservation laws of nonlinear evolution equations in multi-spatial dimensions. The algorithm uses the Euler operator to test exactness and the homotopy operator to invert the total divergence without explicit integration by parts on the jet space. Calculus-based formulas for the operators will be presented together with their application in the symbolic computation of densities and fluxes. Using a system of shallow water wave equations as an example, a Mathematica package will be demonstrated that automates the computation of conservation laws of nonlinear PDEs in (3+1)-dimensions.