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Conservation laws of the nonlinear two-fluid model

A nonlinear model has been derived by Camassa and Choi (1999) to approximate the two-dimensional Euler equations of incompressible motion of two non-mixing fluids in a channel. We derive conservation laws for the two-fluid model using the direct conservation law construction method. Eight different conservation laws are found, including the conservation of mass, horizontal momentum, and energy. The conserved quantities for the Camassa-Choi model are compared with those for the full incompressible Euler system. A physical interpretation is given for each of the conservation laws of the two-fluid model.