The Eulerian-Lagrangian method of fundamental solutions for the hyperbolic system problem

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The objective of this paper is to develop a meshless numerical model for dealing with the system of hyperbolic equations. The proposed method based on the diffusion fundamental solution and the Eulerian-Lagrangian method is able to easily handle the hyperbolic equations. First we transfer the coupled hyperbolic system to the system of the decoupled pure-advection equations, and then approximate the solutions with the proposed meshless numerical scheme. The proposed numerical method is free from mesh, numerical quadrature and can easily transform the physical variables between the Eulerian and Lagrangian coordinates. There are some numerical tests for validating the proposed numerical scheme and the numerical results compared well with the analytical solutions. The problem of the linear shallow water equations is analyzed by the proposed meshless method and the results are compared well with the analytical solutions. Therefore the proposed model is a promising numerical solver for the hyperbolic system.

Keywords: Meshless numerical method, method of fundamental solutions, hyperbolic system, shallow water wave.