

Towards automatic solvers of Riemann problems

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Riemann problems for diffusive conservation laws are highly nonlinear and often have solutions that are complex. Complexity arises from the nonlinearity coupled with the diverse scales of transport and diffusion. It is manifested as rich bifurcation structures in the solution. Riemann problems remain the cornerstone for the organization of solutions, so that understanding them is mandatory in the mathematics and physics of conservation laws. Also, numerous modern numerical methods are based on approximations of Riemann solutions. Because these and other reasons, automatic software for finding Riemann solutions is desirable. We present our work on such software and explain how it is useful in devising optimal petroleum production strategies in reservoir engineering.