Error Analysis in Various Shock Physics Problems

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Our purpose is to seek robust and understandable error models for shock physics simulations. First, for 1D planar problems, we developed statistical models for ensemble uncertainty and numerical errors. A composition law was further formulated and validated to estimate errors in the solutions of composite problems in terms of the errors from simpler ones. In a further study of spherically symmetric 1D shock interactions, the error analysis is complicated by a nonconstant power law growth or decay of error between interactions (as are the waves themselves non constant and growing or decaying by power laws). Our current effort is directed to a 2D shock implosion problem. This problem is chaotic, and fails to converge in the normal sense, revealing new solution detail with each new level of mesh refinement. Our approach to this difficulty is to introduce some level of averaging and seek convergence of averaged quantities or of their statistical description (means, variances, higher statistics). Preliminary results for this problem are presented.