Mathematics > Analysis of PDEs

Formation of singularities in solutions to ideal hydrodynamics of freely cooling inelastic gases

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(Submitted on 2 Jul 2011)

We consider solutions to the hyperbolic system of equations of ideal granular hydrodynamics with conserved mass, total energy and finite momentum of inertia and prove that these solutions generically lose the initial smoothness within a finite time in any space dimension n for the adiabatic index $\gamma \le 1+\frac{2}{n}.$ Further, in the one-dimensional case we introduce a solution depending only on the spatial coordinate outside of a ball containing the origin and prove that this solution under rather general assumptions on initial data cannot be global in time too. Then we construct an exact axially symmetric solution with separable time and space variables having a strong singularity in the density component beginning from the initial moment of time, whereas other components of solution are initially continuous.

Comments:	13 pages, 3 figures
Subjects:	**Analysis of PDEs (math.AP)**; Soft Condensed Matter (cond-mat.soft); Mathematical Physics (math-ph)
MSC classes:	35L60, 76N10, 35L67
Cite as:	**arXiv:1107.0365 [math.AP]**
	(or **arXiv:1107.0365v1 [math.AP]** for this version)

Submission history

From: Rozanova Olga [view email]

[v1] Sat, 2 Jul 2011 09:41:07 GMT (36kb)

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