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Some Exact Solutions to the Coagulation Equation with Product Kernel

An important phenomenon in a wide variety of processes in physics, chemistry, biology, medicine and engineering is the coalescence or aggregation of small clusters of particles into larger ones. Examples include, but are not limited to, polymerization processes in polymer science, coagulation processes in aerosol and colloidal physics, planet and galaxy formation.

Coagulation processes are governed by integro-differential equations known as coagulation equations. The nature of the solution of these coagulation equations will depend on the form of the coagulation kernel that appears in the equation. One interesting feature of these equations is that, depending on the coagulation kernel used, mass need not be conserved. The phenomenon whereby conservation of mass breaks down in finite time is known as "gelation" and is physically interpreted as being caused by the appearance of an infinite "gel" or "superparticle".

For certain forms of the coagulation kernel exact solutions to the coagulation equation can be found.