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The Key Contribution of Joseph-Louis Lagrange (1736-1813) to the Theory of Partial Differential Equations

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The theory of partial differential equations (PDEs) is a powerful mathematical tool used to describe as well as to solve a huge number of physical problems (e.g., the shape of the Earth or the hypothetical interstellar diffusion of a civilization in our Galaxy). From an historical point of view, however, the subject of PDEs was not consciously created by mathematicians as in the case, for instance, of ordinary differential equations (ODEs). The first PDE studies in the Eighteenth century were mainly devoted to second order equations because the physical problems led directly to them (e.g., the wave equation). The main challenge, however, was to consider a new class of equations where both spatial and temporal coordinates were often linked due to the intrinsic nature of the physical problem. Moreover, the boundary value problems, that had only a marginal importance in ODEs had to be emphasized when operating with multidimensional spaces. Accordingly, new mathematical approaches were necessary to develop. In this talk I outline the historical evolution of the theory concerning the PDEs during the Eighteenth century as well as the key role of some European mathematicians, notably, Joseph-Louis Lagrange (1736-1813) in solving first-order PDEs is reconstructed.

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