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Autore	Christodoulou Demetrios
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The equations describing the motion of a perfect fluid were first formulated by Euler in 1752. These equations were among the first partial differential equations to be written down, but, after a lapse of two and a half centuries, we are still far from adequately understanding the observed phenomena which are supposed to lie within their domain of validity.   These phenomena include the formation and evolution of shocks in compressible fluids, the subject of the present monograph. The first work on shock formation was done by Riemann in 1858. However, his analysis was limited to the simplified case of one space dimension. Since then, several deep physical insights have been attained and new methods of mathematical analysis invented. Nevertheless, the theory of the formation and evolution of shocks in real three-dimensional fluids has remained up to this day fundamentally incomplete.   This monograph considers the relativistic Euler equations in three space dimensions for a perfect fluid with an arbitrary equation of state. We consider initial data for these equations which outside a sphere coincide with the data corresponding to a constant state. Under suitable restriction on the size of the initial

departure from the constant state, we establish theorems that give a complete description of the maximal classical development. In particular, it is shown that the boundary of the domain of the maximal classical development has a singular part where the inverse density of the wave fronts vanishes, signalling shock formation. The theorems give a detailed description of the geometry of this singular boundary and a detailed analysis of the behavior of the solution there. A complete picture of shock formation in three-dimensional fluids is thereby obtained. The approach is geometric, the central concept being that of the acoustical spacetime manifold. The monograph will be of interest to people working in partial differential equations in general and in fluid mechanics...