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Generalized solutions of nonlinear partial differential equations, by Elemér E. Rosinger. Mathematical Studies, vol. 146, North-Holland, Elsevier Science Publishers, Amsterdam, 1987, xvii + 409 pp., US $ 92.00; Dfl 175.00. ISBN 0-444-70310-1

Why the need for generalized solutions of partial differential equations? It has been recognized that many equations of physics do not have classical solutions (for instance shock wave solutions of systems of conservation laws). Distribution solutions—usually called "weak solutions"—of the model equation

$$u_t + uu_x = 0$$

are defined as those integrable functions u which satisfy: $\forall\psi \in \mathscr{C}^\infty(\mathbf{R}^2)$ with compact support

$$(1)\qquad \iint \left[u(x,t)\frac{\partial}{\partial t}\psi(x,t) + \frac{1}{2}u^2(x,t)\frac{\partial}{\partial x}\psi(x,t)\right] dx\,dt = 0.$$

In the case of linear equations a detailed theory has been developed [**15**, 7]. However the situation is far from being satisfactory. Lewy [**8**] showed that the very simple linear equation

$$(2)\qquad \frac{\partial}{\partial x_1}u + i\frac{\partial}{\partial x_2}u - 2i(x_1 + ix_2)\frac{\partial}{\partial x_3}u = f$$