Generalized real analysis and its applications

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Pseudo-analysis is basing on the fact that instead of the usual field of real numbers a semiring is taken on a real interval of the extended real numbers with pseudo operations: pseudo-addition and pseudo-multiplication. Starting from the semiring structure, it is developed by Maslov and his group the so called idempotent analysis, and then in a more general setting (Sugeno, Murofushi, Pap, Klir, Grabisch, Mesiar, Wang, Weber) the so called pseudo-analysis in an analogous way as classical analysis, introducing pseudo additive measures, pseudo-integral, pseudo-convolution, pseudo-Laplace transform, etc. There are applications in optimization problems, nonlinear partial differential equations, nonlinear difference equations, optimal control, decision making, game theory, fuzzy systems, etc. This structure is applied for solving nonlinear equations (ODE, PDE, difference equations) using the pseudo-linear superposition principle, which means that a pseudo-linear combination of solutions of the considered nonlinear equation is also a solution. The advantage of the pseudo-analysis is that there are covered with one theory, and so with unified methods, problems (usually nonlinear and uncertain) from many different fields. Important fact is that this approach gives also solutions in the form which are not achieved by other theories, e.g., Bellman difference equation, Hamilton-Jacobi equation with non-smooth Hamiltonians. On one side it is important to investigate the basic real operations with different properties, see [1], and to develop further the whole theory, see [2, 3].

References

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