Fuzzy solutions to differential equations

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This talk explores old and new possibilities of using fuzzy set theory in input-output systems modelled by differential equations. On the one hand, uncertainty of the input and in the system can be described by fuzzy sets. This leads to differential equations with fuzzy data. The talk will present a general fuzzy framework in which existence and uniqueness of a fuzzy solution is guaranteed. The approach is based on the functorial property of the extension principle. On the other hand, fuzzy set theory can be used to provide a notion of generalized solutions as an alternative model of non-differentiable, weak solutions. We demonstrate how this new concept works in the case of shock waves in fluid dynamics.

[1] M. Oberguggenberger, S. Pittschmann: *Differential equations with fuzzy parameters*, Math. and Computer Modelling of Dynamical Systems 5(1999), 181 - 202.

[2] M. Oberguggenberger: *Fuzzy and weak solutions to differential equations*, Proceedings of the Tenth International Conference IPMU 2004, Perugia. Editrice Università La Sapienza, Italy 2004, 517 - 524.

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