Orbital convergence of timestepping schemes for non-smooth mechanics

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When simulating mechanical systems with impacts, velocity jumps occur. Timestepping schemes are well-known possibilities to integrate such dynamical systems. Their advantage is the avoided event detection such that a large number of changes of the active set – especially accumulation points of velocity jumps – can be handled with higher computational efficiency, in particular when single events are less important than the mean. These schemes are always of integration order one with respect to discrete L^p-norms. This is a consequence of the identification of impact points only with order one independently of the approximation order in the smooth phases. In this talk, the idea of orbital convergence of timestepping schemes is presented, which is a more reasonable tool to compare the approximation accuracy of different timestepping methods [1, 2, 3]. Using the framework of measure differential inclusions, the orbital convergence order of these schemes is studied for scalar problems. An experimental convergence analysis with the bouncing ball and the impact oscillator examples will underline the benefits of this approach.

References

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