Non-uniformly hyperbolic dynamics for some classes of piecewise smooth systems.

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We consider piecewise smooth systems (PWS) of ordinary differential equations. The phase space is supposed to be split into two (or more) subsets with a threshold being a piecewise smooth surface. For such systems, smoothly depending on a parameter, the so-called grazing bifurcation is considered. Roughly speaking, this bifurcation corresponds to the existence of a periodic solution tangent to the threshold.

Basing on the approaches of previous author’s works and some new ideas on estimating Lyapunov exponents for near-grazing periodic solutions, we describe non-uniformly hyperbolic invariant sets for some classes of PWS. In other words, local coexistence of infinitely many periodic solutions with distinct dimensions of stable/unstable manifolds is proved for those classes of PWS. In addition, we discuss how the developed theory may be applied to study dynamics of strongly nonlinear systems e.g. the van der Pol equation.