

Combining fixpoints and derivatives has many fruitful applications in computer science and mathematics. In this talk, I will present a categorical framework to combine them in the case of Cartesian (closed) differential categories with a fixpoint operator by introducing an additional axiom relating the derivative of a fixpoint with the fixpoint of the derivative. The standard examples of Cartesian differential categories where we can compute fixpoints provide canonical models of this notion. As an application, I will show how this framework provides a convenient setting to formalize the Newton-Raphson iteration scheme for fast approximation of fixpoints and extend it to higher order languages. This is based on joint work with Jean-Simon Pacaud Lemay.