

# Implicit Differential Equations: Singularity Crossing Phenomena and Impasse Points

María Etchehoury\*

Co-authors: Hernán Cendra\*\* and Germán Zorba\*

\*Universidad Nacional de La Plata

\*\*Universidad Nacional del Sur

ARGENTINA

**Implicit Differential Equations -IDEs-**, also called **Differential Algebraic Equations -DAEs-**, provide a valuable tool for system modeling in different fields: circuit theory, constrained mechanics, control theory, among others.

**Reduction methods**, based on the so called **geometric index**, describe the behaviour of an autonomous IDE in terms of a vector field defined on the solution set, which has a manifold structure. This vector field defines an ODE on this manifold and induces a flow on it. In this case we refer to these systems as **regular** and the points of the solution manifold are **regular points**.

**Singular points or singularities** of an IDE will be defined as those where the assumptions supporting the definition of index fail.

In this talk, by studying a reparametrized ODE equivalent in some sense to the original IDE, we get conditions that ensure existence of two types of singularities: **impasse points and crossing phenomena**.