# Codimension two singularities of sliding vector fields

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**Abstract**

The main aim of this paper is to study the behavior of the so called *Sliding Vector Fields* around an equilibrium point. Such systems emerge from ordinary differential equations on $\mathbb{R}^3$ with discontinuous right-hand side. In this work an analysis of generic codimension two bifurcation diagram is performed by given a complete topological study of its phase portrait as well as the respective normal forms.

## 1 Introduction

The main aim of this paper is to study a class of codimension two singularities of the so called Sliding Vector Fields ($SVF$). Such systems emerge from ordinary differential equations on $\mathbb{R}^3$ with discontinuous right-hand side (see for instance [F] and [U]). In our approach we assume that these discontinuities occur on the $2-$ *sphere* $M = S^2$ and the rules for defining the solution orbits of such ODE are made via Filippov's convention (see [F]). In [T3] all the codimension one singularities were analyzed and we refer to it for the necessary background. In this work a singularity analysis of generic codimension-two bifurcation diagrams is performed by giving a complete topological study of its phase portrait as well as the respective normal forms.

In what follows we give some preliminaries and basic definitions.

Let $p \in M$ and $f : (\mathbb{R}^3, M) \to (\mathbb{R}, 0)$ be a $C^\infty$ representation of M at p, with $df(p) \neq 0$. So M is the separating boundary of the regions $M_+ = \{f > 0\}$ and $M_- = \{f < 0\}$.

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