Discontinuity Induced Bifurcations in Machining Applications

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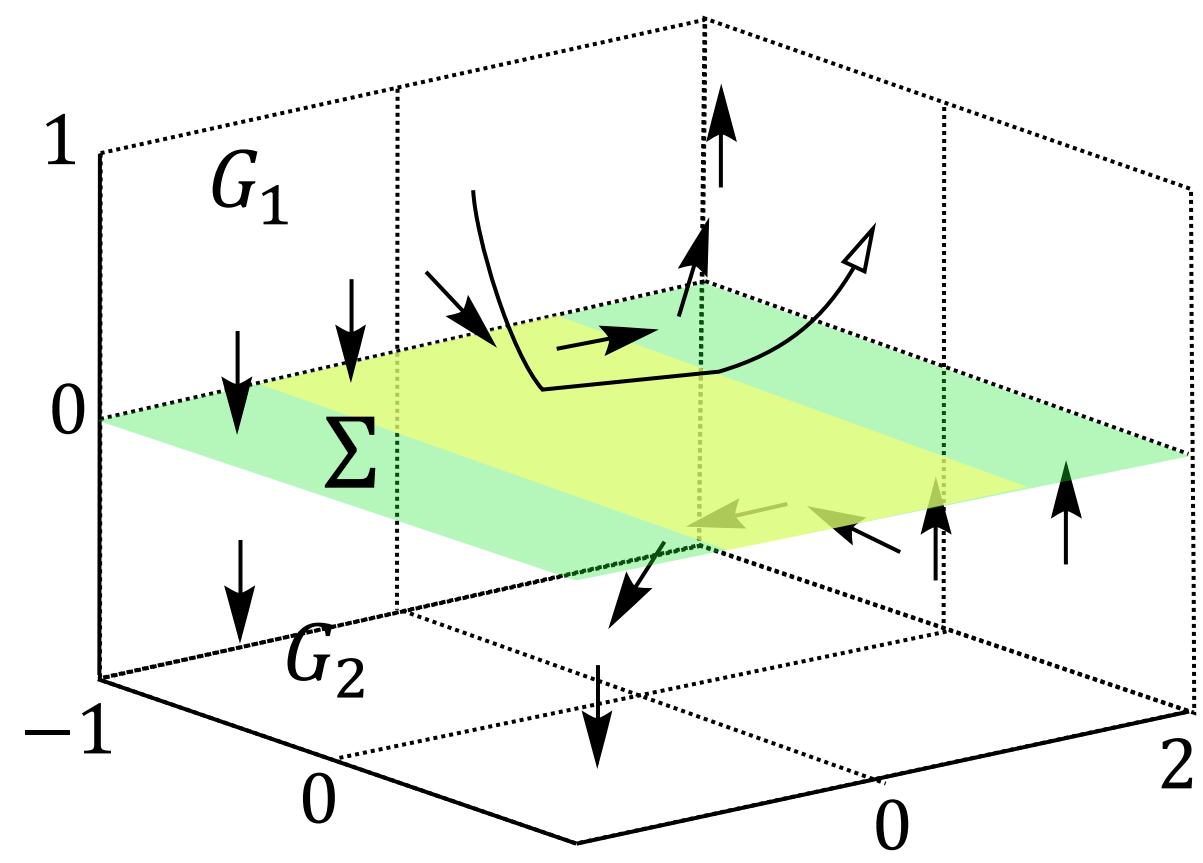**School of Mechanical and Materials Engineering, University College Dublin, Dublin, Ireland.**

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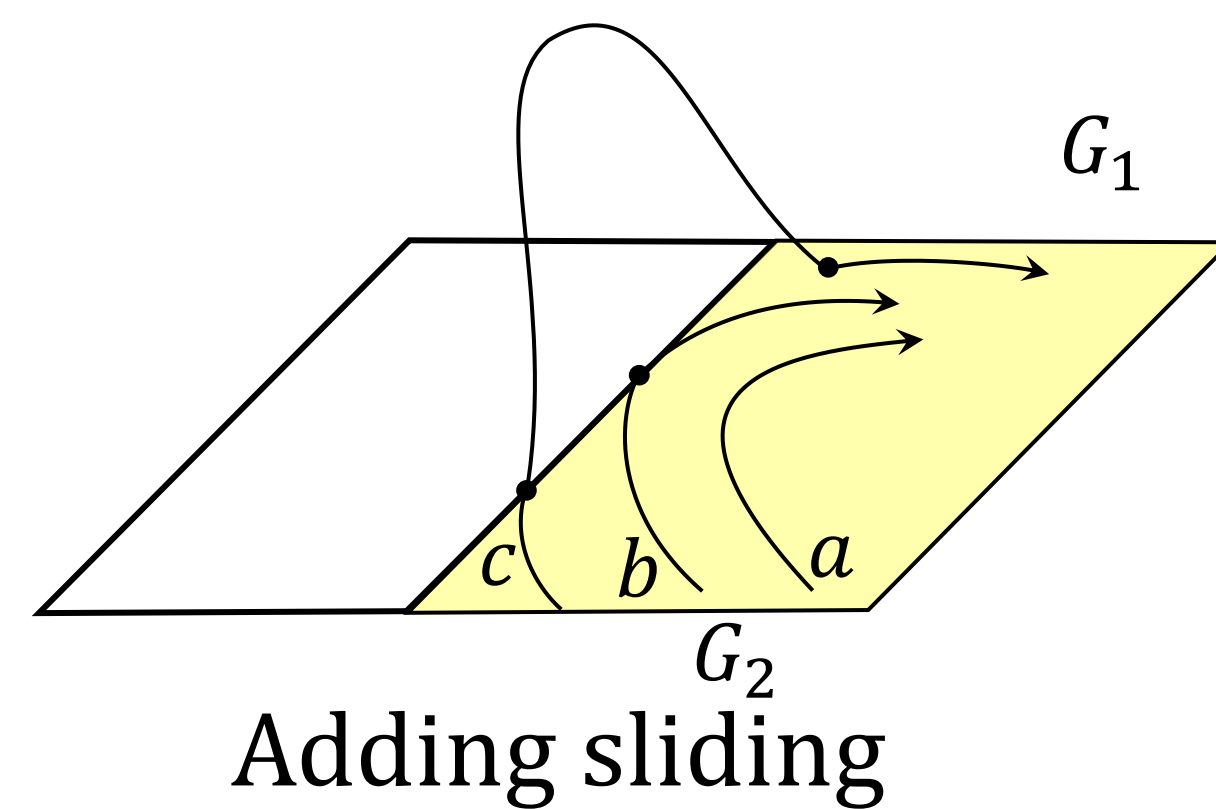vikram.pakrashi@ucd.ie
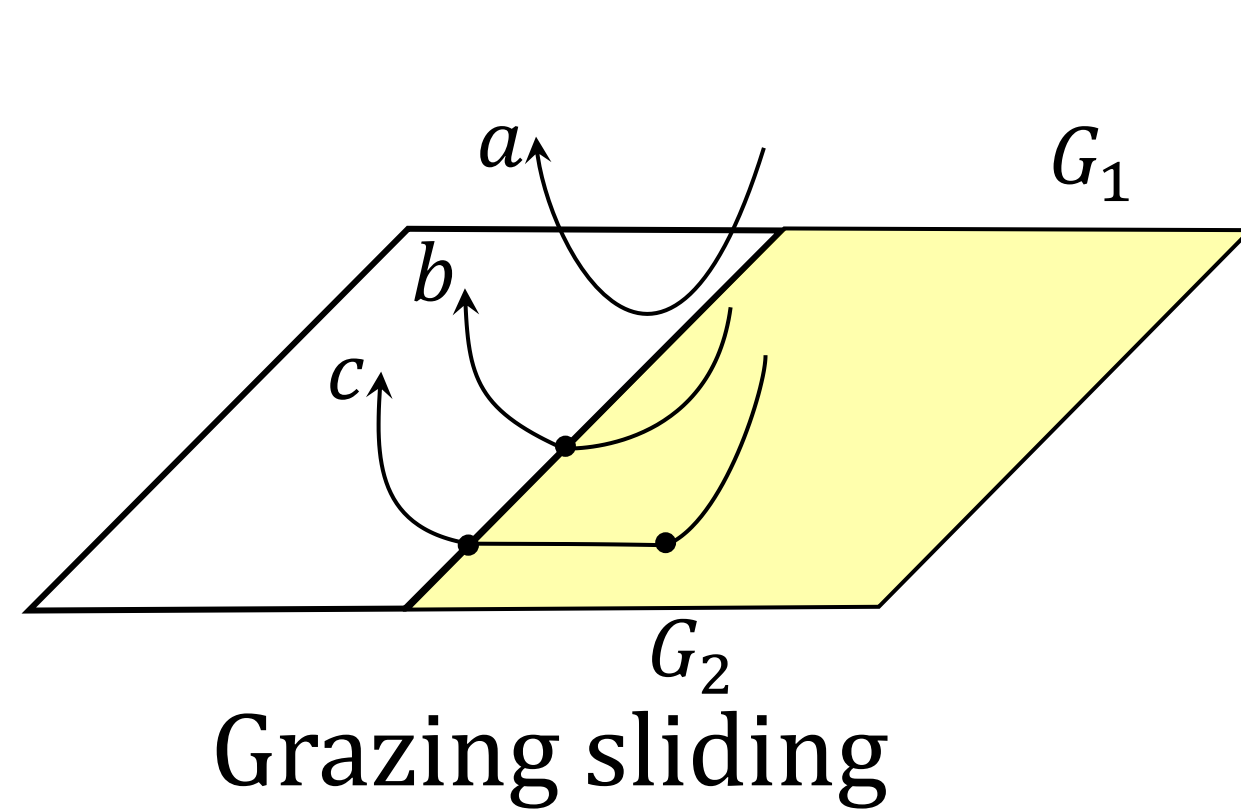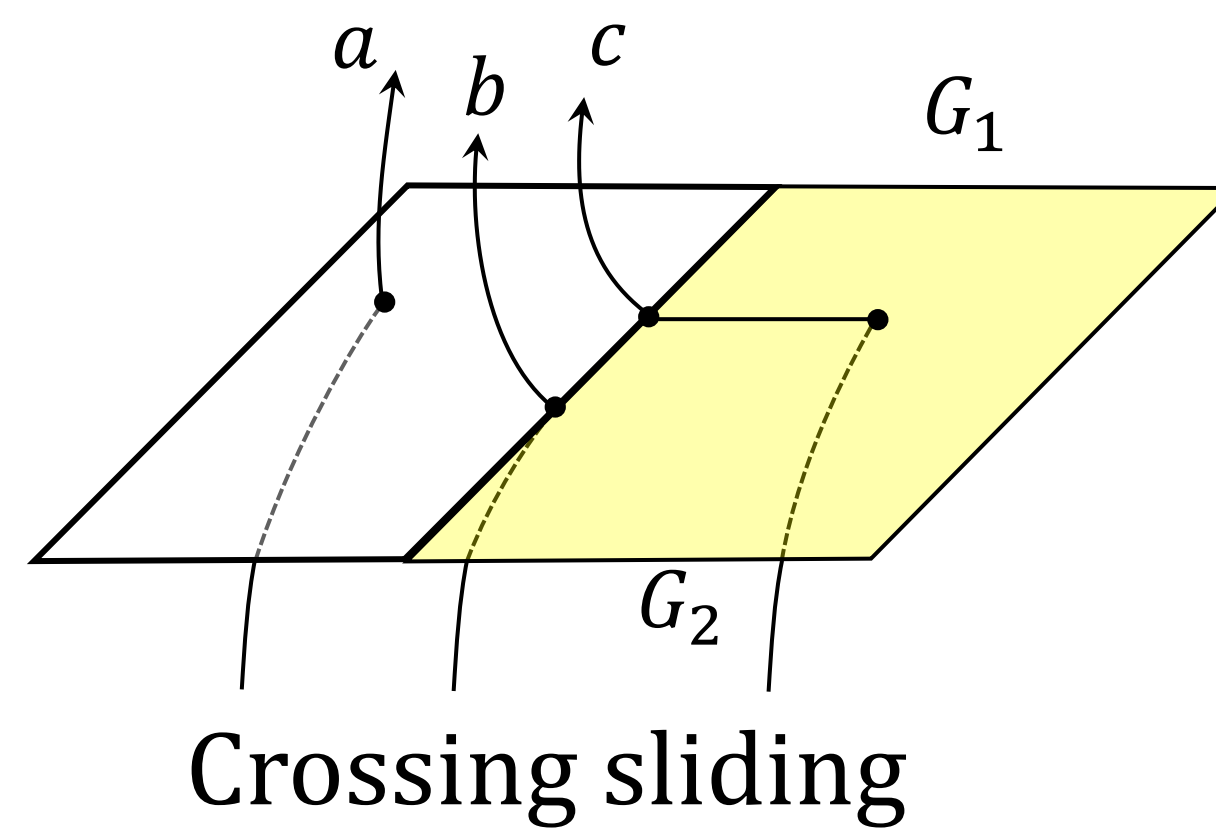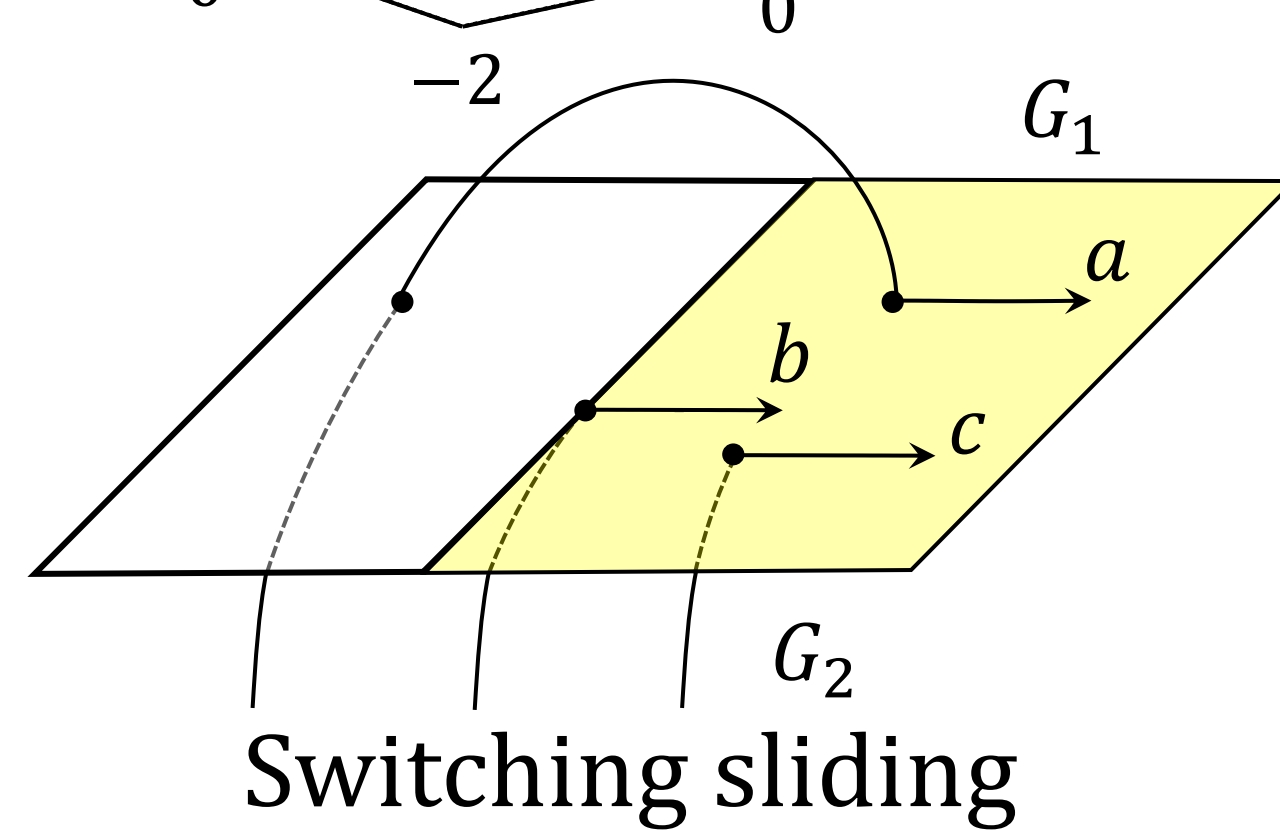aasifa.rounak@ucd.ie

Introduction

- Non-smooth dynamical systems are characterized by discontinuities in state space.

- Bifurcation refers to the qualitative changes in the behaviour of the system as certain parameters are varied.
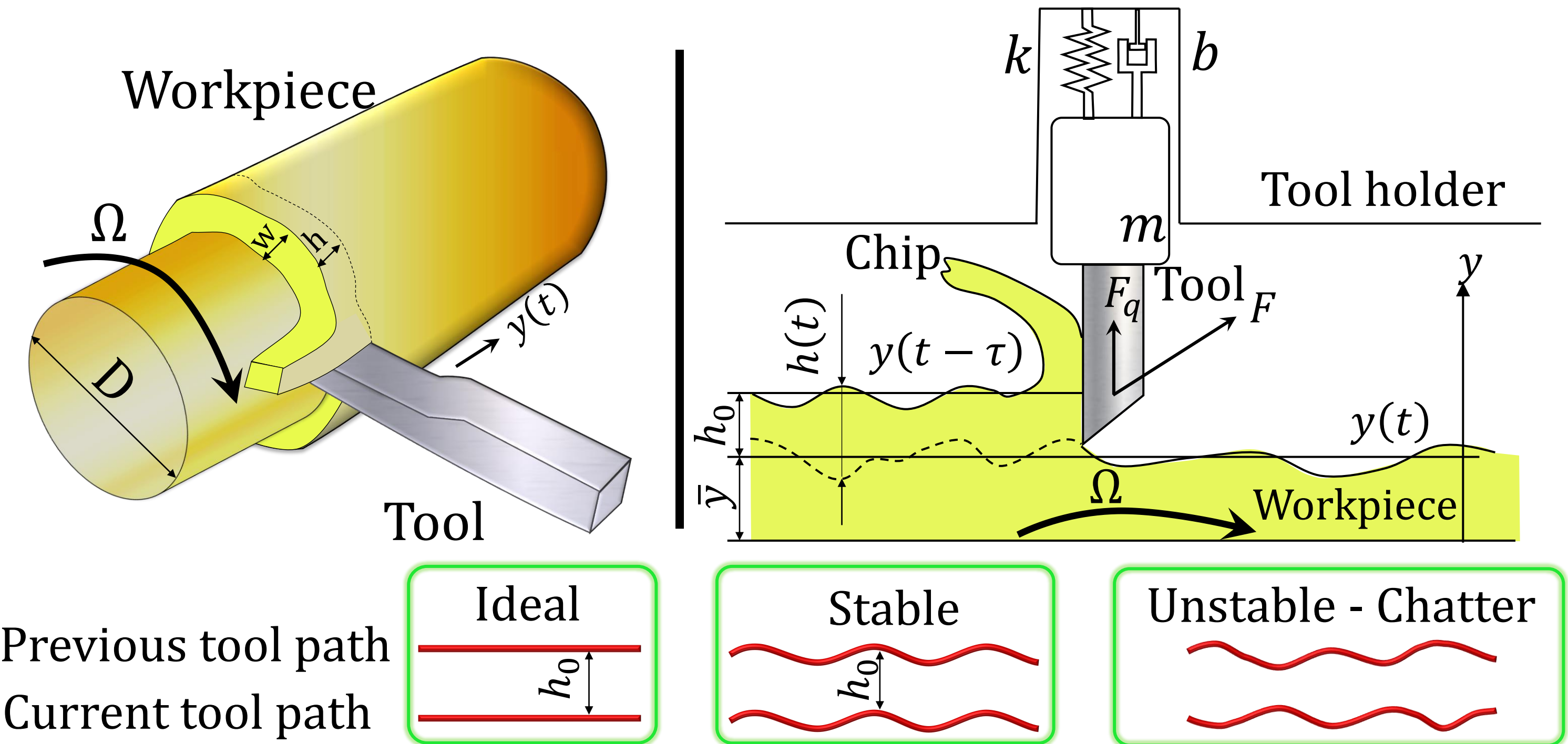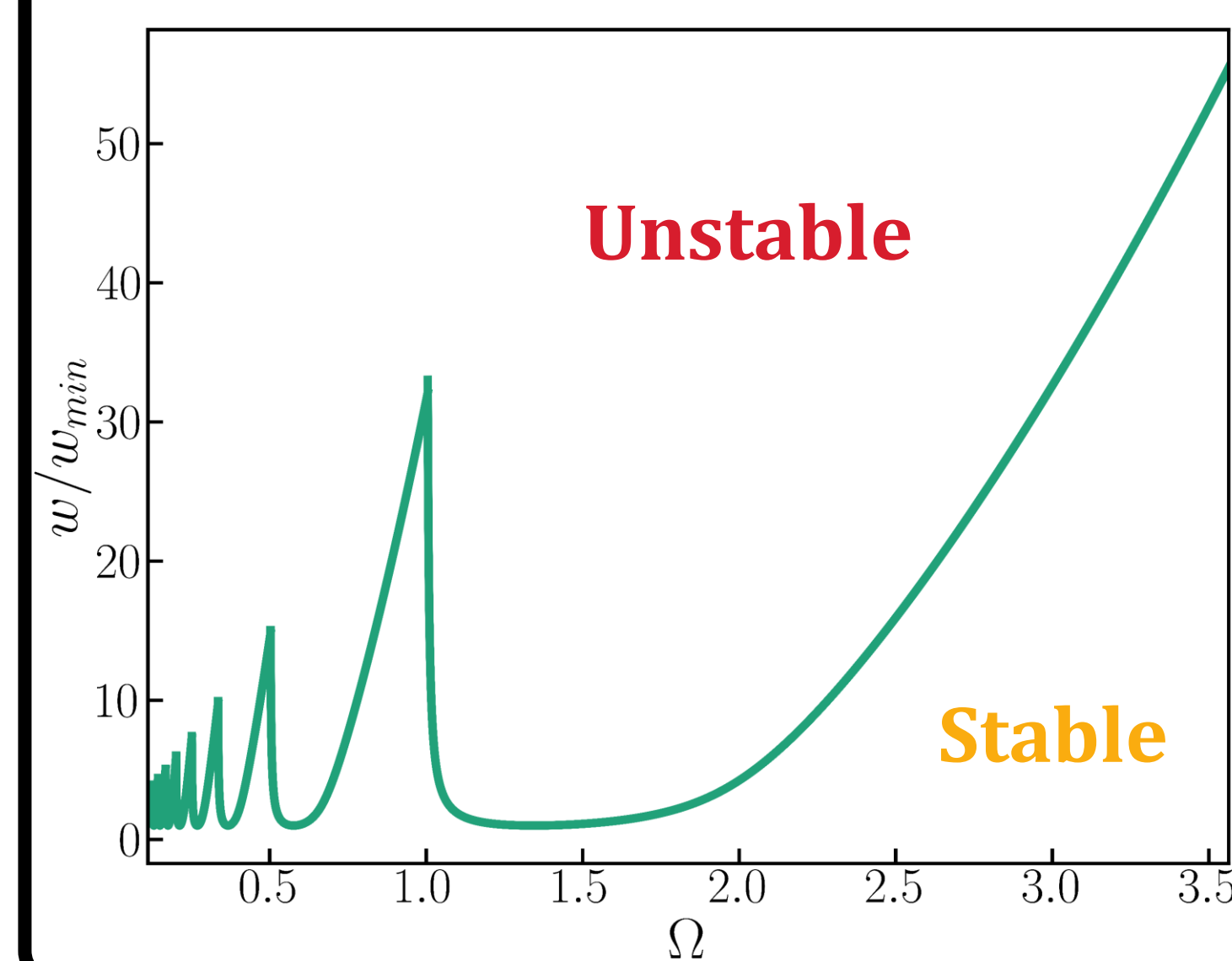
Sliding Bifurcations

$$\dot{x} \in F(x) = \begin{cases} F_1(x) & x \in G_1 \\ \overline{co}(F_1(x), F_2(x)) & x \in \Sigma \\ F_2(x) & x \in G_2 \end{cases}$$
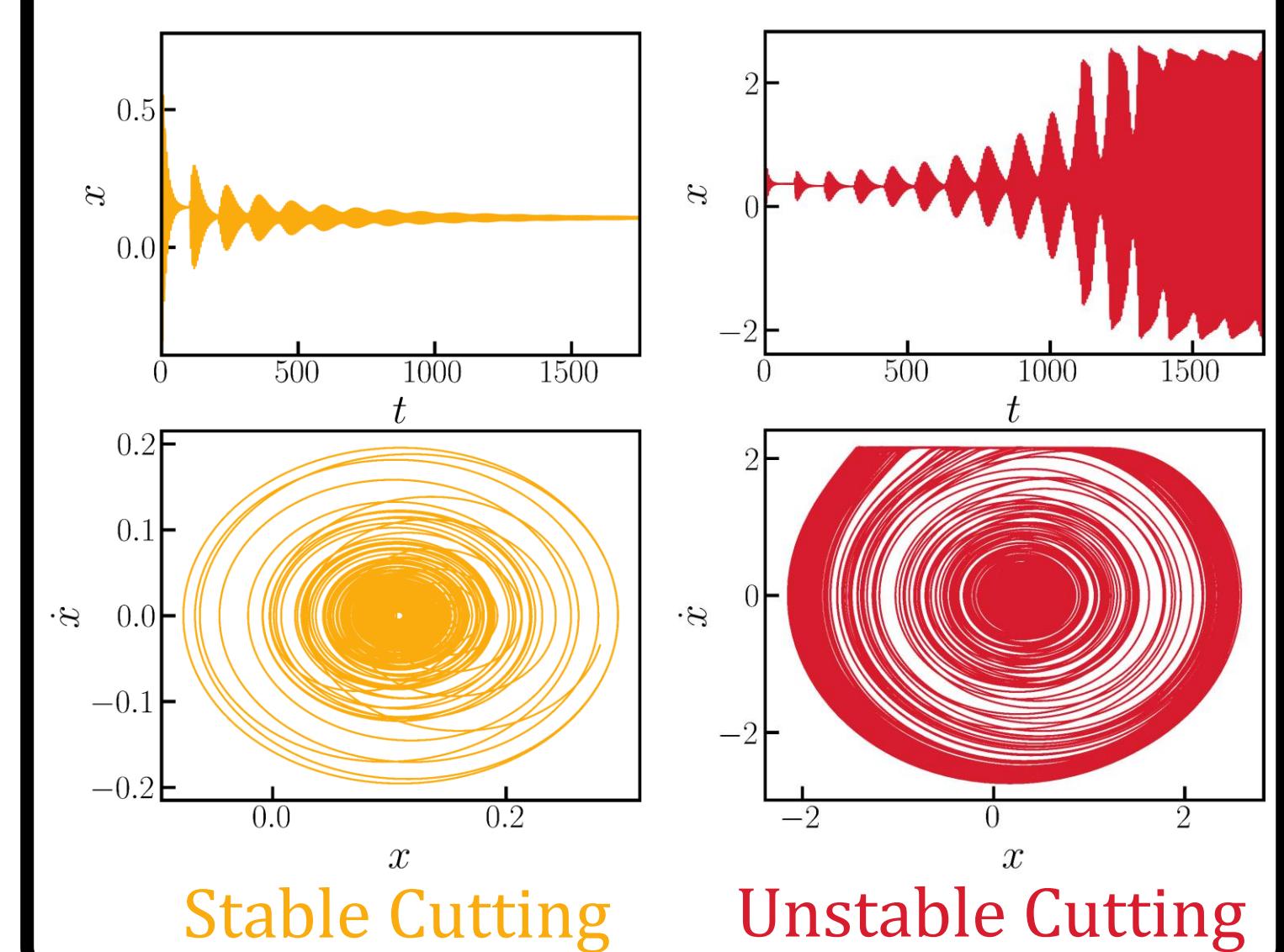
Switching sliding

Crossing sliding

Grazing sliding

Adding sliding

Schematic Diagram

Previous tool path
Current tool path

Ideal | Stable | Unstable - Chatter

Stability Lobe Diagram

Unstable

Stable

Tool dynamics

Stable Cutting

Unstable Cutting

References

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[3] Dombovari, et al., *Int. J. Non Linear Mech.,* **46** 330-338 (2011).