Data-Driven Mechanics Laboratory

Master thesis / Semester project

Frictional instabilities in topologically interlocked structures

Description: Topologically interlocked structures (TIS) represent a new class of innovative designs inspired by the mechanics of puzzles [1]. Constructed from individual building blocks that interlock without the use of adhesives, these structures exhibit remarkable mechanical properties, relying solely on contact and frictional forces for their integrity. Experimental observations have revealed sudden failures and sharp load drops in TIS, indicating that frictional slip instabilities play a significant role in their structural response. This project aims to explore the influence of stick-slip frictional instabilities and interfacial heterogeneity on the failure mechanisms of TIS. Using the level-set discrete element modeling framework, the student will investigate the dynamic behavior of these systems under various conditions. The project offers an opportunity to delve into the unique mechanical behavior of TIS and gain experience with modern computational tools in structural engineering.

Prerequisites:

- Background and interest in structural mechanics and friction
- Strong coding skills (Python, C++)

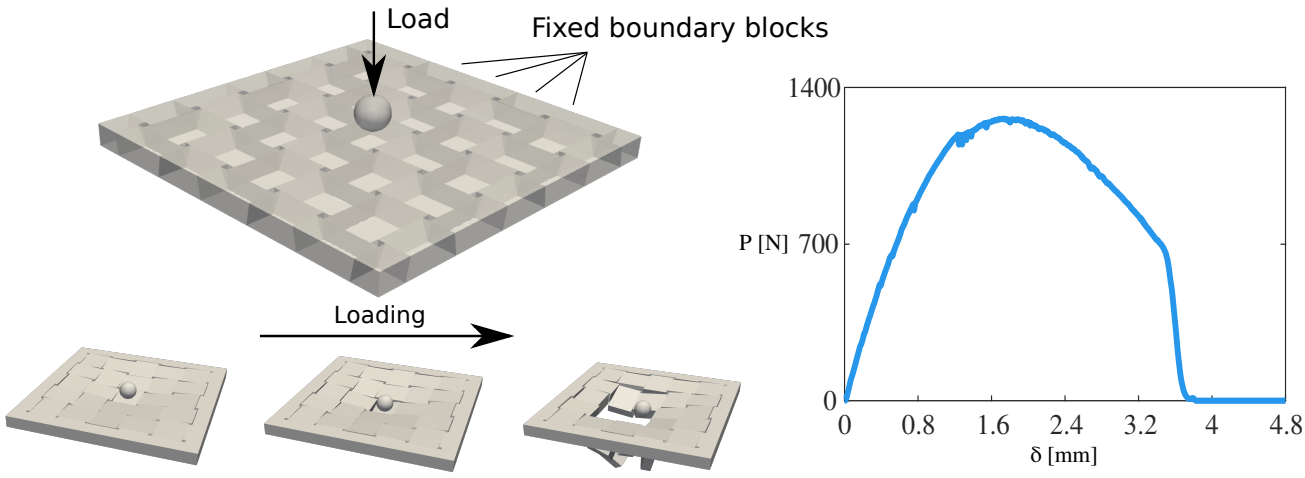

Figure 1: Failure pattern of a topologically interlocked slab (left) and its force-displacement response up to failure (right).

References

[1] Shai Feldfogel, Konstantinos Karapiperis, Jose Andrade, and David S Kammer. Failure of topologically interlocked structures—a level-set-dem approach. *European Journal of Mechanics-A/Solids*, 103:105156, 2024.

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