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Simplified Industrial Dispersions: Prediction the yielding behaviour from a simple elastoplastic approach

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Introduction

About 85% of industrial formulations pass at least one stage of the "lifetime" as a colloidal dispersion. The increasing interest in greener and more sustainable alternatives is pushing industry towards the simplification of products' formulation (do more with less). These changes in the design paradigm require a better understanding, and therefore description, of complex phenomena relevant in several applications [1], with stability against gravitational collapse being one of these engineering challenges.

In the proposed project the focus lies on predicting the long-term mechanical stability of industrial dispersions. Proper shelf-life estimation before adverse, and often irreversible, changes in the product occur appears of uttermost importance to minimize waste of both material and energy. Industrially, the tendency is to use indexing techniques to describe the mechanical response [2], but those offer only a rough representation of the material behavior. While fundamental research addresses similar issues, the focus often revolves around ideal representative materials, limiting generalization to real-world industrial systems [3,4].

Goals

The project is twofold. Firstly, to develop precise estimations of the long-term stability of industrial materials and standardize a protocol for its assessment. Secondly, integrate advanced fundamental concepts with the industrial samples' response.

- Formulate replica samples of industrial formulations
- Use benchmark rheological characterization techniques with the produced samples
- Use cutting edge constitutive model to predict long term stability and yielding inset
- Compare mechanical description measured though indexing techniques and rheometers

Learning outcomes

- You will learn about industrial challenges in engineering design of soft matter
- You will learn characterization techniques in colloidal dispersions (rheology, light scattering)
- You get the opportunity to interact with leading industrial companies in a range of application fields (Syngenta, Dow, Chemours, Cargill, Merck)
- You will learn about modelling and using AI

Type of project

- Master semester project
- Master thesis

References

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