

# **Optimization of coating process in deformable roll coating systems by means of fluid flow simulation of non-Newtonian liquids**

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## **Abstract**

The roll to roll deformable coating systems with non-Newtonian fluids have been studied for many years since the last century, however there are few good numerical models performed on this topic, especially the ones that could be used in the industrial applications. Most of the researchers have focused on the methods and result analysis, rather than scalability and industrial application. For the industry the study of the coating thickness is important because paint is a consumable, and all the wasted paint during the production are wasted money. Therefore, this work focuses on the research of the methods for the numerical model of the roll to roll coating system with the coating thickness as a target output parameter.

In this study, the 18.2 Ansys software was used for the simulation. Ansys Structural was used to for the elastomer model development, based on the experimental results of the deformable coater layer. Ansys Fluent was used for the fluid domain of the system, where the VOF (Volume of Fluid) multiphase model was implemented to simulate the free surface of the paint. Methods to solve the numerical solution were chosen to maximize the precision of the air and paint interface for a better precision of the model.

As a results, the domain, geometry, mesh and boundary conditions of mechanical, fluid and coupled system were developed. The model with the best coefficients for the non-Newtonian paint and applicator roll elastomer was chosen and implemented in the solution. The results were obtained for both regular and non-Newtonian fluids as a function of support roll speed, applicator roll speed and separation distance between the rolls. Through the research, also the architecture for the recommendation system was proposed. All the performed work lies as a grounding foundation for the roll to roll coating recommendation system.

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