101e Modeling and Control of Continuous Tumble Mixing of Granular Materials

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The change in powder mixing schemes from batch to continuous is being prompted by the availability of instrumentation and a more simplified production scheme. This work is focused on the development of a semi-empirical model for modeling and control of a continuous tumble mixing. The model incorporates the assumptions that the powder level variation inside the mixer has the same behavior of a Newtonian liquid discharging from an orifice by the effect of the gravitational force, and that the densities of noncohesive granular materials are similar and remain constant during the mixing process. The model also assumes an exponential expression for the behavior of variance of mixing as a function of fill level inside the mixer and its rotational velocity. The results of the output variables (material outlet flow and variance of mixing) followed the trends observed by others authors but in batch mixers. The model was then used to develop two control strategies: Proportional Integral (PI) and Multivariable Predictive Control (MPC), using as input variables the inlet flow of material to mix and the rotational velocity of the mixer. Both strategies were compared in terms of stability, robustness, overshoots on set-point tracking, performance and capacity to reject the effects of load disturbances through simulations.