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## Predictive Modelling of the Granulation Process Using a Systems-Engineering Approach

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### Abstract

The granulation process is considered to be a crucial operation in many industrial applications. The modelling of the granulation process is, therefore, an important step towards controlling and optimizing the downstream processes, and ensuring optimal product quality. In this research paper, a new integrated network based on Artificial Intelligence (AI) is proposed to model a high shear granulation (HSG) process. Such a network consists of two phases: in the first phase the inputs and the target outputs are used to train a number of models, where the predicted outputs from this phase and the target are used to train another model in the second phase to lead to the final predicted output. Because of the complex nature of the granulation process, the error residual is exploited further in order to improve the model performance using a Gaussian mixture model (GMM). The overall proposed network successfully predicts the properties of the granules produced by HSG, and outperforms also other modelling frameworks in terms of modelling performance and generalization capability. In addition, the error modelling using the GMM leads to a significant improvement in prediction.

**Keywords:** High shear granulation; integrated network; radial basis function; ensemble model; Gaussian mixture model.

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