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Estimating the Time to Reach the Curing Temperature in Autoclave Curing Processes

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Autoclave curing process is one of the important stages in manufacturing. In this process, multiple parts are loaded in the autoclave as a batch, they are heated up to their curing temperature (heating phase) and cured at that temperature for their dwell period. There are two main considerations that affect how parts are placed in the autoclave. Firstly, if some parts reach the curing temperature earlier than the others, they are overcured until the remaining parts reach that temperature. This overcuring worsens the quality of the final products. Secondly, shorter curing cycles are preferred to increase productivity of the whole system. Both considerations can be addressed if the time required for each part to reach the curing temperature (heating time) is known in advance. However, there are no established relationships between part properties and their heating times. In this study, we develop the relation between part and batch properties with the heating times. We consider the effects of location, part weight, part size, and batch properties on the heating times. The autoclave charge floor is imaginarily divided in 18 areas and for each area multiple linear regression models that estimate the heating times are developed. Additionally, a biobjective optimization model is developed that finds efficient placements of parts, minimizing the maximum overcuring duration and the duration of the heating phase. The approach is applied on a real case, and an efficient solution is implemented. The regression models result in significantly close estimations to the realizations.

Keywords

Multiple Linear Regression; Parts Placement in Autoclave; Multiobjective Optimization

Special/invited session

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