

## Accepted Manuscript

Application of genetic and simulated annealing algorithms for optimization of infrared heating stage in thermoforming process

F. Erchiqui

PII: S1359-4311(17)30977-8

DOI: <https://doi.org/10.1016/j.applthermaleng.2017.09.102>

Reference: ATE 11159

To appear in: *Applied Thermal Engineering*

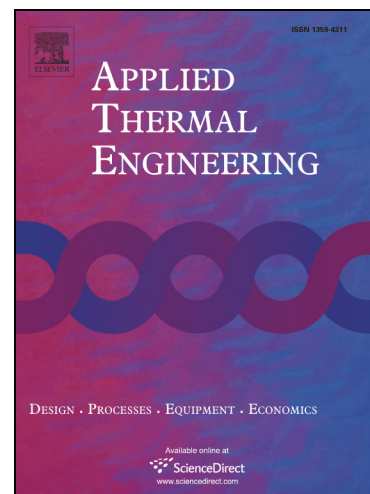
Received Date: 13 February 2017

Revised Date: 16 September 2017

Accepted Date: 20 September 2017

Please cite this article as: F. Erchiqui, Application of genetic and simulated annealing algorithms for optimization of infrared heating stage in thermoforming process, *Applied Thermal Engineering* (2017), doi: <https://doi.org/10.1016/j.applthermaleng.2017.09.102>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Application of genetic and simulated annealing algorithms for optimization of infrared heating stage in thermoforming process

F. Erchiqui

Université du Québec en Abitibi-Témiscamingue  
445, boul. de l'Université, Rouyn-Noranda (Québec) J9X 5E4  
Canada  
[fouad.erchiqui@uqat.ca](mailto:fouad.erchiqui@uqat.ca)

**Abstract:** In thermoforming, the shaping of the thermoplastics takes place essentially in two principals steps: infrared heating (IR) in an oven and then shaping the desired product using a mold of given geometry. The quality of the molded product depends directly on the temperature distribution in the material during infrared heating and indirectly on the temperature and optical properties of the radiant zones. To ensure that the energy flux intercepted by the thermoplastic sheet is uniform, we propose the application of two meta-heuristic algorithms MA (Simulated annealing algorithm) and GA (Genetic algorithms) to detect, from a fixed and random set of temperatures of the radiant zones of oven, the best temperatures that must be assigned to the heating zones. For numerical heating analysis, the nonlinear heat conduction problem is solved by a specific 3D volumetric enthalpy-based finite element method. The view factor is estimated by a semi-analytical method. An example of optimization of the heating stage of the high-density polyethylene (HDPE) grade sheet is presented.

**KEYWORDS:** Simulated annealing; genetic algorithm; optimisation; infrared heating; finite element; thermoforming.

### 1. INTRODUCTION

The shaping processes of the thermoplastic parts are numerous and very complex. For thermoforming, the quality of a part depends on several variables such as: properties of the sheet (thermo-physical and thermo-mechanical), heating time, deformation mechanism and residence time in the mold cavity (solidification) [1-3]. The prediction of thickness and residual stress distributions induced in the thermoformed part requires robust modeling of energy, momentum equations and fluid-structure interaction between the air and the viscoelastic plastic sheet [3-5]. However, for the

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات