Abstract

In this article, the problem of computing an optimal heat input in Luikov's heat and mass transfer problem is detailed and analyzed. The main objective is the establishment of an optimal time-dependent heat flux profile with the goal of maximizing the temperature and moisture sensitivities of some parameters to this excitation in a drying process. Such maximization makes the estimation of the desired parameters possible, easier, and with limited uncertainty intervals. It also helps to reduce the linearity dependence between the parameters of interest and the number of temperature and moisture sensors used. The estimation of the optimal heat input is obtained with Uzawa's algorithm, while the estimation of parameters is performed with Levenberg-Marquardt's method of minimization of the ordinary least-square criterion. The six dimensionless parameters characterizing Luikov's equations are estimated successfully with this optimal heat flux profile, which also helps to reduce the number of both temperature and moisture sensors needed in the estimation procedure. By doing so, the objective of estimating simultaneously the six parameters which appear in the formulation of Luikov's physical problem is reached by using a limited transient temperature and/or moisture measurements taken anywhere in the drying medium