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Abstract: Hybrid modeling approaches have recently been investigated as an attractive alternative to model fermentation processes. Normally, these approaches require estimation data to train the empirical model part of a hybrid model. This may result in decreasing the generalization ability of the derived hybrid model. Therefore, a simultaneous hybrid modeling approach is presented in this paper. It transforms the training of the empirical model part into a dynamic system parameter identification problem, and thus allows training the empirical model part with only measured data. An adaptive escaping particle swarm optimization (AEPSO) algorithm with escaping and adaptive inertia weight adjustment strategies is constructed to solve the resulting parameter identification problem, and thereby accomplish the training of the empirical model part. The uniform design method is used to determine the empirical model structure. The proposed simultaneous hybrid modeling approach has been used in a lab-scale nosiheptide batch fermentation process. The results show that it is effective and leads to a more consistent model with better generalization ability when compared to existing ones. The performance of AEPSO is also demonstrated.