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基于混合优化算法的无叶片粒子分离器优化设计

Optimization design of vaneless inlet particle separator based on hybrid algorithm

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中文关键词: [粒子分离器](#) [气固两相流](#) [多目标优化](#) [代理模型](#) [混合优化算法](#)

英文关键词: [particle separator](#) [gas-solid two phase flow field](#) [multi-objective optimization](#) [surrogate model](#) [hybrid algorithm](#)

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中文摘要:

将混合优化算法引入粒子分离器优化设计,减小粒子分离器流动损失并简化结构.利用四次样条曲线参数化描述粒子分离器模型,建立粒子分离器自动化仿真流程.采用优化拉丁方实验设计方法获取样本点并建立椭圆径向基函数神经网络代理模型,基于该模型使用非支配排序遗传算法进行全局多目标优化,最后采用序列二次规划算法进行局部优化,得到了粗砂分离效率达到100%、细砂分离效率达到86.7%,总压损失小于0.6%、出口总压畸变较小的设计方案.

英文摘要:

To reduce flow loss and simplify the structure of the inlet particle separator (IPS), hybrid optimization algorithm was introduced into the IPS optimization design. Firstly, four order spline curve was adopted as parameterized description of the IPS model and an automated simulation process was established. Optimal Latin hypercube design (OLHD) method was used to obtain the sample points, and an elliptical radial basis function (EBF) surrogate model was established to substitute the simulation code. Then non-dominated sorting genetic algorithm (NSGA-II) was used for multi-objective optimization based on surrogate model, and finally non-linear programming by quadratic Lagrangian (NLPQL) algorithm was applied to local optimization. As a result, a new configuration was obtained, with the scavange efficiency of C-spec distribution improved to 100% and 86.7% for AC coarse distribution fine sand and total pressure reduced to less than 0.6% with smaller main outlet pressure distortion.

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