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过程系统工程

带路径约束的聚烯烃牌号切换操作优化方法

费正顺, 胡斌, 叶鲁彬, 郑平友, 梁军

浙江大学工业控制研究所，工业控制技术国家重点实验室，浙江 杭州 310027

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摘要

产品多样化需求使得聚烯烃生产过程中经常需要进行牌号切换操作。以往关于牌号切换优化的研究大多只关心切换过程结束后聚合物质量指标是否达到目标牌号值，对过渡过程中质量指标及状态变量的波动情况缺少关注，而过程的波动会影响到最终产物的质量性质和操作平稳性。为此，本文以聚乙烯气相流化床反应器为对象，通过在牌号切换优化命题中加入关于熔融指数等的路径约束，防止过渡过程中的状态变量剧烈波动影响聚合物树脂质量。为求解此类带路径约束的动态优化问题，对常规的控制变量参数化方法进行了改进，通过求解微分代数方程（DAE方程）将路径约束转化为控制变量约束。仿真结果表明，加入路径约束可以有效避免牌号切换中变量的剧烈波动，增强过程平稳性。

关键词

聚合反应 牌号切换 控制变量参数化 路径约束

分类号

Optimal grade transition of polymerization process with path constraints

FEI Zhengshun,HU Bin,YE Lubin,ZHENG Pingyou,LIANG Jun

Abstract

To meet a demand for various polymer products，grade transitions are frequently required in the polymerization process.The recent studies for grade transition optimization mostly focused on adjusting the quality specifications to target values.However，the variations on quality specifications and state variables during the grade transition will greatly affect the operation stability of the system and the product qualities.In this study，the authors proposed a simple and effective approach to alleviate the fluctuations during grade transition by adding path constraints to the optimization structure of grade transition in a gas-phase fluidized bed reactor for polyethylene.The path constraints were transformed to control variable constraints by solving the differential algebraic equation，which significantly improves the traditional control vector parameterization method to solve dynamic optimization problems with path constraints.The simulation results confirm the effectiveness of the proposed approach to enhance the operation stability.

Key words

polymerization grade transition control vector parameterization path constraints

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通讯作者 梁军 jliang@iipc.zju.edu.cn