INTISARI

OPTIMISASI MULTIOBJEKTIF PADA ALOKASI TRUK PENAMBANGAN MENGGUNAKAN METODE BERBOBOT DAN ALGORITMA *MULTIOBJECTIVE PARTICLE SWARM OPTIMIZATION*

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Optimisasi *cycle time* ekskavator merupakan faktor krusial dalam meningkatkan efisiensi operasional pertambangan, namun sering terhambat oleh ketidakseimbangan alokasi sumber daya dan variasi kondisi lapangan. Penelitian ini bertujuan untuk meminimalkan total *cycle time* melalui pendekatan multiobjektif dengan meminimumkan tiga fungsi objektif: total *hanging time* ekskavator (Z_1), total waktu tunggu truk (Z_2), dan total deviasi laju aliran material (Z_3). Metode pembobotan dan algoritma *multiobjective particle swarm optimization* (MOPSO) diterapkan dengan fungsi penalti untuk menangani kendala kapasitas ekskavator dan truk. Simulasi dilakukan menggunakan data historis operasional yang melibatkan 31 truk, 4 ekskavator, dan 1 *dumping point*. Analisis Pareto *front* menunjukkan adanya *trade-off* antar fungsi objektif, sehingga pemilihan solusi optimal perlu mempertimbangkan keseimbangan antara produktivitas ekskavator, efisiensi pemanfaatan truk, dan kestabilan laju produksi material.

ABSTRACT

MULTIOBJECTIVE OPTIMIZATION IN MINING TRUCK ALLOCATION USING THE WEIGHTED METHOD AND MULTIOBJECTIVE PARTICLE SWARM OPTIMIZATION ALGORITHM

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Optimization of excavator cycle time is a crucial factor in improving mining operational efficiency, but it is often hindered by imbalanced resource allocation and varying field conditions. This study aims to minimize the total cycle time through a multiobjective approach by minimizing three objective functions: total excavator hanging time (Z_1), total truck waiting time (Z_2), and total deviation of material flow rate (Z_3). A weighting method and the multiobjective particle swarm optimization (MOPSO) algorithm are applied, incorporating a penalty function to handle excavator and truck capacity constraints. The simulation uses historical operational data involving 31 trucks, 4 excavators, and 1 dumping point. The Pareto front analysis reveals trade-offs among the objective functions, indicating that selecting the optimal solution must consider a balance between excavator productivity, truck utilization efficiency, and the stability of material production flow.