UNIVERSITAS
GADJAH MADA
**Penerapan Multi-Objective Adaptive Large Neighborhood Search (MOALNS) untuk Optimasi Double Row
Layout Problem dengan Mempertimbangkan Safety Distance dan Geometrical Constraint**
Belinda Tirza Amalia, Ir. Achmad Pratama Rifai, S.T, M.Eng, Ph.D.,IPM
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Aktivitas produksi pada lini manufaktur dengan konfigurasi baris ganda menghadapi tantangan dalam menentukan tata letak terbaik sembari mempertimbangkan berbagai aspek operasional secara bersamaan. *Double Row Layout Problem* (DRLP) dalam penelitian ini turut mempertimbangkan *safety distance* antar mesin, serta batasan *geometrical* berupa perbedaan panjang antar baris akibat keberadaan fasilitas *fixed position* agar lebih merepresentasikan kondisi nyata di dunia industri. Dua fungsi tujuan yang saling bertentangan menyebabkan pendekatan *multi-objective* digunakan untuk menghasilkan himpunan solusi *non-dominated* dengan berbagai tingkat kompromi antara kedua fungsi objektif yang tidak dapat dituntaskan dengan pendekatan *single-objective*.

Algoritma *Multi-Objective Adaptive Large Neighborhood Search* (MOALNS) dirancang sebagai solusi metaheuristik untuk permasalahan ini. Algoritma terdiri dari tujuh operator *destroy* dan enam operator *repair* yang dipilih melalui mekanisme *roulette wheel* dengan kriteria penerimaan solusi mengadopsi mekanisme AMOSA. Algoritma MOALNS dijalankan pada *27 instance benchmark* dengan sepuluh repetisi per *instance*. Empat metrik evaluasi digunakan untuk mengukur kualitas solusi yang dihasilkan, yaitu *Hypervolume* (HV), *Euclidean Distance* (ED), *Sum of Objectives* (SO), dan *Spacing*.

Hasil MOALNS dibandingkan terhadap empat algoritma pada paper acuan, yaitu AMOSA, NSGA-II, MOVNS, dan IMOVNS. MOALNS unggul pada 26 dari 27 *instance* di metrik HV, SO, dan *Spacing*. Pada metrik ED, MOALNS unggul lebih sedikit, yaitu 23 dari 27 *instance* karena pada beberapa *instance* berukuran kecil performanya lebih rendah dibanding algoritma pembanding. Pareto *front* yang dihasilkan menawarkan sejumlah alternatif tata letak dengan tingkat kompromi berbeda antara efisiensi biaya dan pemenuhan jarak aman.

Kata Kunci: *double row layout problem*, optimasi *multi-objective*, *adaptive large neighborhood search*, *safety distance*, *geometrical constraint*

UNIVERSITAS
GADJAH MADA
**Penerapan Multi-Objective Adaptive Large Neighborhood Search (MOALNS) untuk Optimasi Double Row
Layout Problem dengan Mempertimbangkan Safety Distance dan Geometrical Constraint**
Belinda Tirza Amalia, Ir. Achmad Pratama Rifai, S.T, M.Eng, Ph.D.,IPM
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ABSTRACT

*Production activities on manufacturing lines with a double row configuration face the challenge of determining the optimal layout while simultaneously considering various operational aspects. The Double Row Layout Problem (*DRLP*) in this study also takes into account the safety distance between machines and geometrical constraint in the form of differences in row length due to the presence of fixed-position facilities, in order to better represent real-world conditions in the industrial sector. Two conflicting objective functions necessitate the use of a multi-objective approach to generate a set of non-dominated solutions with varying levels of trade-off between the two objectives that cannot be resolved through a single-objective approach.*

*The Multi-Objective Adaptive Large Neighborhood Search (*MOALNS*) algorithm was designed as a metaheuristic solution for this problem. The algorithm consists of seven destroy operators and six repair operators selected via a roulette wheel mechanism, with a solution acceptance mechanism adapted from* AMOSA*. The* MOALNS *algorithm was run on* 27 *benchmark instances with ten repetitions per instance. Four evaluation metrics were used to measure the quality of the generated solutions: Hypervolume (*HV*), Euclidean Distance (*ED*), Sum of Objectives (*SO*), and Spacing.*

The results of MOALNS *were compared against four algorithms from the reference paper* (AMOSA, NSGA-II, MOVNS, and IMOVNS*). MOALNS outperforms the comparison algorithms in* 26 *out of* 27 *instances for the* HV*,* SO*, and Spacing metrics. For the* ED *metric,* MOALNS *outperforms the comparison algorithms in* 23 *out of* 27 *instances, as its performance is lower than the comparison algorithms in small-sized instances. The resulting* Pareto *front offers several layout alternatives with varying levels of compromise between cost efficiency and safety distance compliance.*

Keywords: *double row layout problem, multi-objective optimization, adaptive large neighborhood search, safety distance, geometrical constraint.*