

**PENENTUAN JALUR EVAKUASI GEDUNG BERTINGKAT
MENGUNAKAN *NON-DOMINATED SORTING
GENETIC ALGORITHM II* (NSGA-II)**

ABSTRAK

Jalur evakuasi merupakan aspek penting dalam proses evakuasi. Penelitian ini meneliti masalah penentuan jalur evakuasi yang optimal pada gedung bertingkat, yaitu jalur evakuasi yang dapat dilalui dengan meminimalkan total waktu evakuasi dan meminimalkan kemacetan selama proses evakuasi dengan mempertimbangkan panjang jalan, kapasitas jalan, jumlah pengungsi, dan distribusi pengungsi di dalam gedung. Jalur evakuasi tersebut dicari dengan merepresentasikan gedung sebagai jaringan, kemudian menggunakan *Non-dominated Sorting Genetic Algorithm II* (NSGA-II) untuk menyelesaikan masalah optimisasi multiobjektif. NSGA-II bekerja dengan cara merepresentasikan solusi dalam bentuk kromosom yang dibentuk dari bilangan biner. Selanjutnya, dilakukan evaluasi pada setiap kromosom terhadap fungsi tujuan. Setelah evaluasi, populasi diurutkan menggunakan *non-dominated sorting* untuk membentuk beberapa *front*. Seleksi *parent* dilakukan berdasarkan urutan *front* dan nilai *crowding distance*. Proses *multi-point crossover* dan *bit-flip mutation* diterapkan untuk membentuk *offspring*. Populasi *parent* dan *offspring* digabungkan dan diseleksi untuk mempertahankan kromosom-kromosom terbaik. NSGA-II dilakukan secara iteratif sampai generasi maksimum tercapai sehingga diperoleh optimal Pareto. Hasil implementasi penentuan jalur evakuasi di gedung Sekolah Pascasarjana UPI menunjukkan bahwa proses evakuasi memerlukan waktu 9 menit dan 26 detik dan rata-rata total kemacetan yang terjadi pada seluruh jalur yang dilalui selama proses evakuasi berlangsung adalah 0,072 orang per panjang jalur.

Kata Kunci: Jalur Evakuasi, Gedung Bertingkat, Optimisasi Multiobjektif, *Non-dominated Sorting Genetic Algorithm II*

**EVACUATION ROUTE DETERMINATION FOR HIGH-RISE
BUILDINGS USING NON-DOMINATED SORTING
GENETIC ALGORITHM II (NSGA-II)**

ABSTRACT

Evacuation routes are an important aspect of the evacuation process. This research is to determine the optimal evacuation route in a high-rise building, which is an evacuation route that minimizes the total evacuation time and minimizes congestion during the evacuation process by considering the length of the road, road capacity, number of evacuees, and distribution of evacuees in the building. The evacuation route is determined by representing the building as a network, then using Non-dominated Sorting Genetic Algorithm II (NSGA-II) to solve the multiobjective optimization problem. NSGA-II works by representing the solution in the form of chromosomes formed from binary numbers. Subsequently, each chromosome is evaluated against the objective function. After evaluation, the population is sorted using non-dominated sorting to form several fronts. Parent selection is performed based on the front order and crowding distance values. Multipoint crossover and bit-flip mutation processes are applied to form the offspring. The parent and offspring populations are combined and selected to retain the best chromosomes. NSGA-II is performed iteratively until the maximum generation is reached to obtain the Pareto optimum. The implementation results of determining the evacuation route in the UPI School of Postgraduate Studies building show that the evacuation process takes 9 minutes and 26 seconds, and the average total congestion that occurs on all paths traveled during the evacuation process is 0,072 people per road distance.

Key Words: *Evacuation Routes, High-rise Buildings, Multiobjective Optimization, Non-dominated Sorting Genetic Algorithm II*