**GASOLINE BLENDING and DISTRIBUTION SCHEDULING**

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**Highlights**

* Graphical GA is used to minimize gasoline blending and distribution operating cost
* The efficacy of the proposed model is checked by solving an industrial problem
* It gives about 1.1-million-euro cost reduction compared to the benchmark reference

**1. Introduction**

Scheduling of gasoline blending and distribution scheduling (SGBD) is a process of allocating resources in the way the cost is minimized without compromising the quality and the demand of the products. Gasoline accounts about 43% of the total crude oil products. According to the ‘International Energy Agency’s (IEA) New Policies Scenario’ [1] estimates, the total crude oil demand will increase from 95 Mb/d to 115 Mb/d between the year 2016 and 2040. Although the usage of renewable energy sources is significantly increasing, for the next two decades, Crude oil will remain the main energy source, particularly for transportation. Therefore, optimizing gasoline blending process enables to boost the profitability and productivity of crude oil refinery plants which intern reduces the environmental load.

Gasoline blending involves combining the refining intermediate products in a way that gasoline yield becomes maximized since gasoline has a high-profit margin compared to the other products. In the meantime, maintaining gasoline property indices such as octane number (ON), Reid vapour pressure (RVP), anti-nocking and stability specifications, sulphur content, ASTM distillation point and flash point come together.

**2. Methods**

A graphical genetic algorithm (GGA) which has a sparse representation compared to the conventional GA (CGA) is used to optimize gasoline blending and distribution process. GGA uses a graphical representation where the material flow is represented by the arrow (edge) and processing units or orders by the box. Here, a discrete time-based (period-wise) model is developed. For each period, unlike CGA, in the chromosome structure, GGA considers only the feasible edges which leads to a tremendous chromosome size reduction. Moreover, it executes genetic operation (crossover and mutation) using a graphical method. During decoding as well as after a genetic operation, the correction will be performed whenever there is constraint violation. Other than the aforementioned differences it follows the same procedure with the conventional NSGA\_II.

**3. Results and discussion**

Using the proposed model, an industrial problem is solved. The result is shown in the table 1. As shown in the table, compared to the CGA there is a significant variable and constraint size reduction for GGA which will enable it to solve complex industrial problems. At the same time, it has around 5 % of production cost reduction compared to the benchmark reference which is a mathematical programming-based model.

Table 1: Model statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of Variables | Number of | | | Costs (k€) | |
| % Reduction over CGA | Constraints for CGA | Penalty function for GGA | % Reduction | Cerda et al [2] | Proposed GGA |
| 87 | 11541 | 309 | 97 | 18517.24 | 17413.85 |

**4. Conclusions**

The proposed model is more compact and has a better computational efficiency compared to the CGA and it also gives a better economic benefit relative to the benchmark reference[2].

[1] E. W. Rocha, P. Huet, and G. M. Mohatarem, The 2040 Economy: Long-term growth determinants, in *Global Economics & Country Risk Conference*, 2014.

[2] J. Cerd, P. C. Pautasso, D. C. Cafaro, and I. U. N. L. Conicet, A Cost-effective model for the gasoline blend optimization problem, *AIChE J.*, vol. 62, no. 9, 2016.