Economical and Environmental Electric Power Dispatch Optimisation

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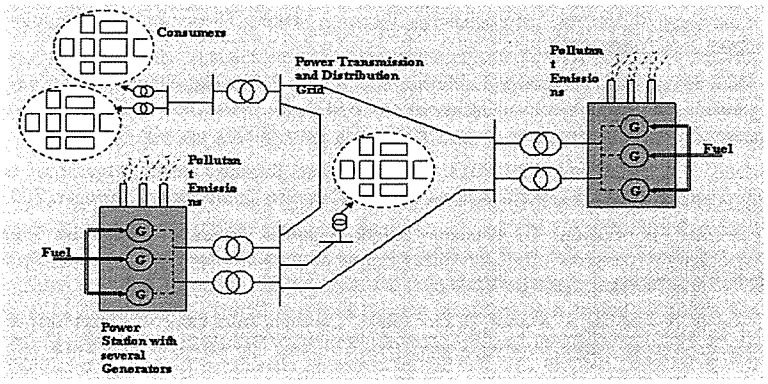
ABSTRACT

In the industry of power production it is crucial to achieve an efficient performance of the power stations or generators and to cover at every moment the power needs in the cheapest possible manner.

However, and due to the ever-growing importance of reducing the environmental impact in all fields, it is also necessary to incorporate the minimisation of the emission to the atmosphere of chemical agents derived from the combustion processes in the generators that burn fossil fuels. Therefore, the problem is treated here from the multi-objective point of view that considers both the total minimisation of the costs associated with power generation and the minimisation of environmental pollution. So, we can find different solutions of the problem according to our aim, such as to obtain economisation, a minimal emission of NOx, a minimal emission of SO_2 or a minimal emission of Particles, or any combination of the already mentioned.



The problem is a multi-criterion optimal programme planning, that has highly random characteristics, and multiple and varied constraints of both inequality and equality kind.

In Galván, Winter et al [1][2][3] a description and resolution are given for the mono-objective power dispatch that designates which generators must be put in place, in which order and with which load to provide the system to minimise the total cost of fuel consumption for a determined power system and during a specific period of time. However, in this paper we solve the multi-objective power dispatch problem with two objectives in conflict: the cost and the emission minimisation of specific atmospheric pollutants.

With more detail, we solve the optimal programme planning of 10 power generators for a period of 24 hours using the NSGA-II with controlled elitism [7] and a flexible mutation using 3% of probability in the frame of the flexible evolution [8] [9] [10] on different mutation operators as candidate mutation operators. Also, the antithetic crossover with probability 1.0 to be used provided good performance. Also, we propose the inclusion in the initial population of a high quality solution regarding to some of the criteria we desire to optimize, thus the algorithm takes advantage of the

information of this monocriteria inserted solution and benefit from it.

We present new and better results for the test case T54.5 of the INGENET European Thematic Network, regarding robustness, computational efficiency, and quality of the solutions.

It must be mentioned that the final target is to provide a complete tool which allows to arrange the load dispatch in power-generating systems from the final making-decision Pareto's frontier relating to the two objectives, minimization of the economical cost and the atmospheric pollutant emissions.

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