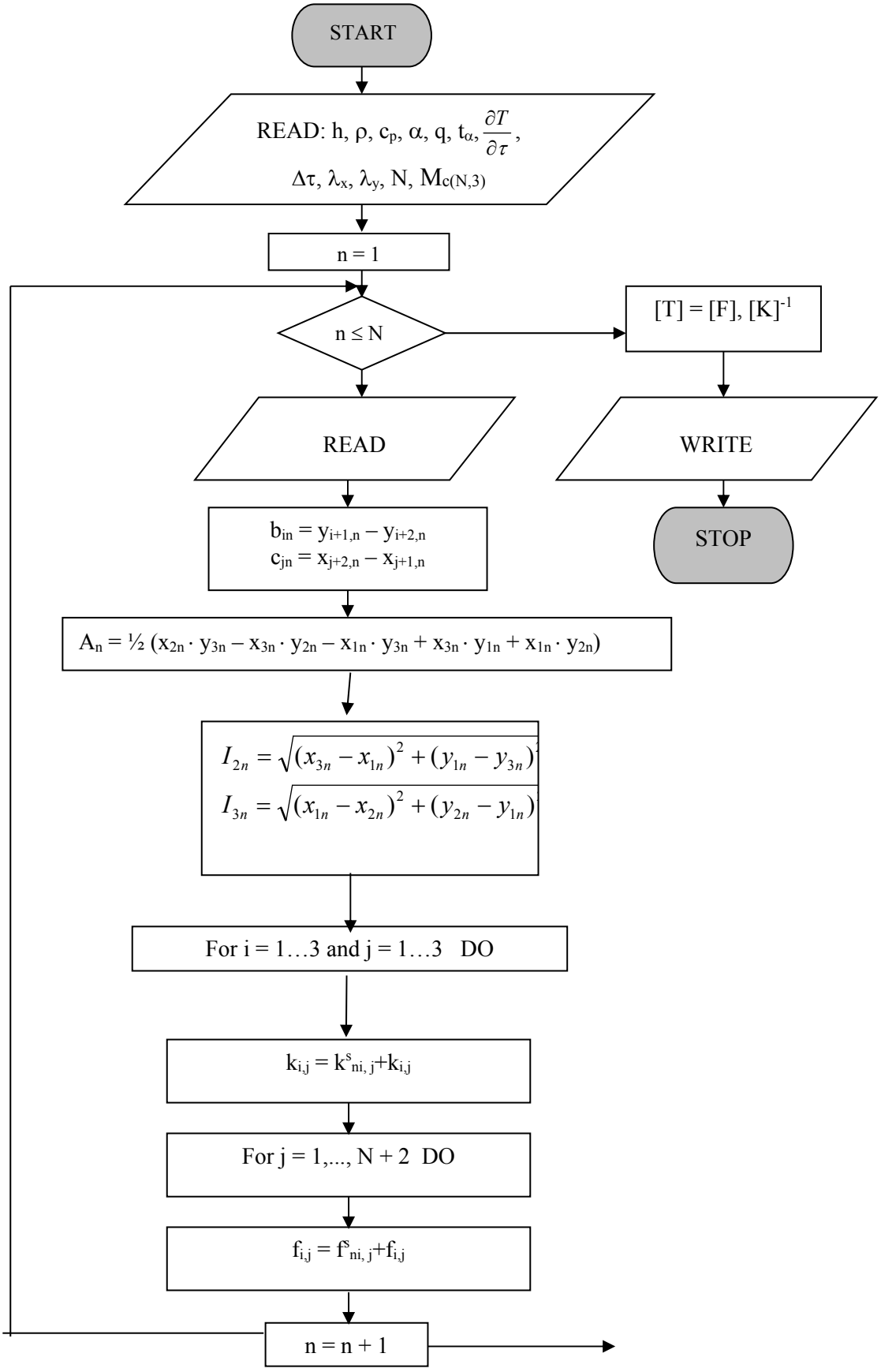


Fig. 5. General logical scheme

Fuzzy Consumption Utility Functions (FCUF) are based on Utility Theory (UT). Fuzzy Utility Function for Consumption (FUFC) is described by the FUFC matrix concept. This concept is based on the following vectors: S (spending vector); P (price vector); CC (consumption composition vector); C (commodity vector) and SV (service values vector).

5 Experimental Rezults

The scheme of the EAF environmental impact is presented in fig. 6.

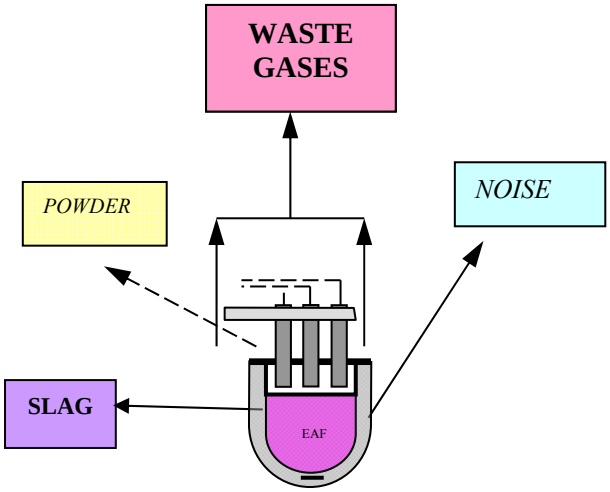


Fig. 6. Scheme of the EAF environmental impact

In fig. 7 is presented the CO concentration in the evacuated gas during the melting in the EAF.

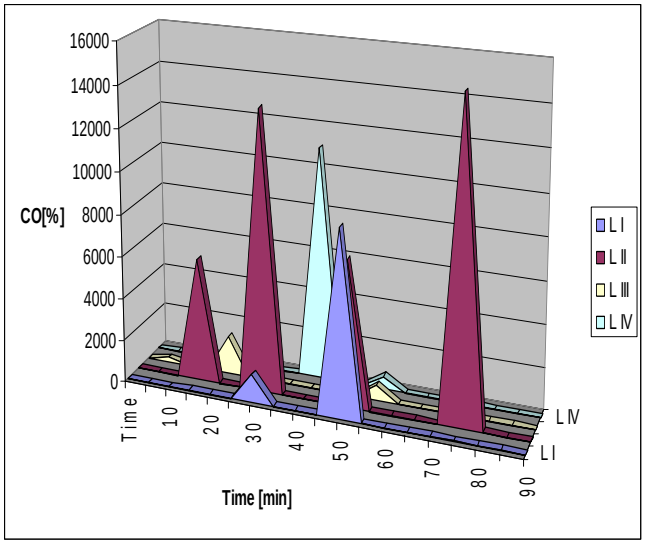


Fig. 7. CO concentration in the evacuated gas during the melting in the EAF

Fig. 8 presents the carbon dioxide impact of EAF [8].

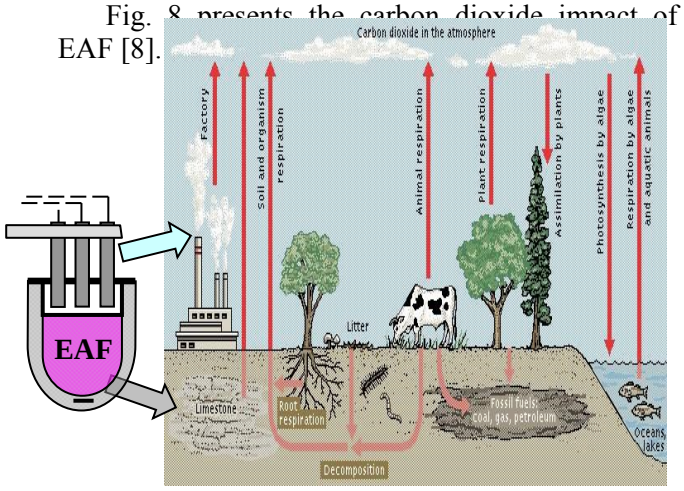
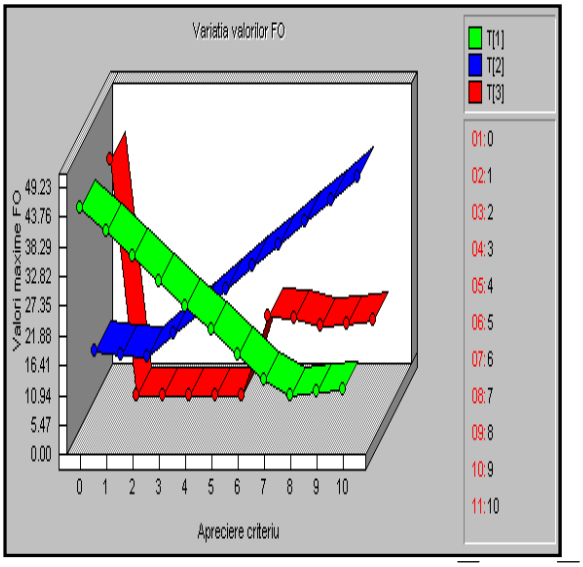


Fig. 8. Carbon dioxide impact of EAF

The correlation between the criteria function's (C.F.) prescribed levels and $\overline{T}$ vector's components' variation is presented in fig. 9.

The execution of the EAF's charge preheating modelling (CPM) was made both for a 10t EAF (fig.10a,b,c) and for a 50t EAF (fig. 10d). It was considered to be a load with medium permeability $\varepsilon = 0.45$.

The cumulated correlation between the criteria



function's (C.F.) prescribed levels and $\overline{T}$ and $\overline{E}$ vectors' variation are presented in fig. 11.

Fig. 9. The correlation between the criteria function 's (CF) prescribed levels and the $\overline{T}$

vector's components' variation $(\overline{T}_1, \overline{T}_2, \overline{T}_3)$

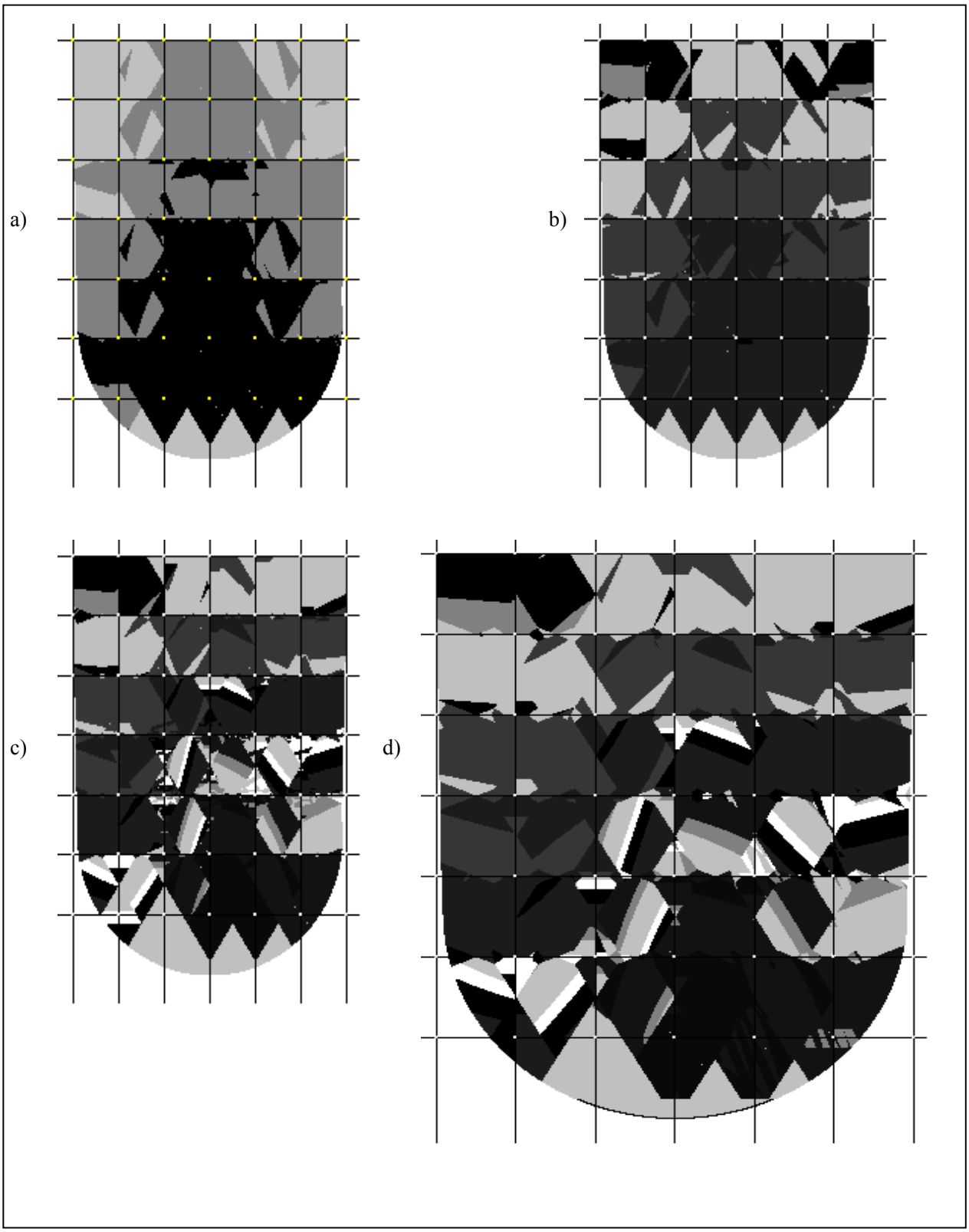


Fig. 10. The main CPM's result

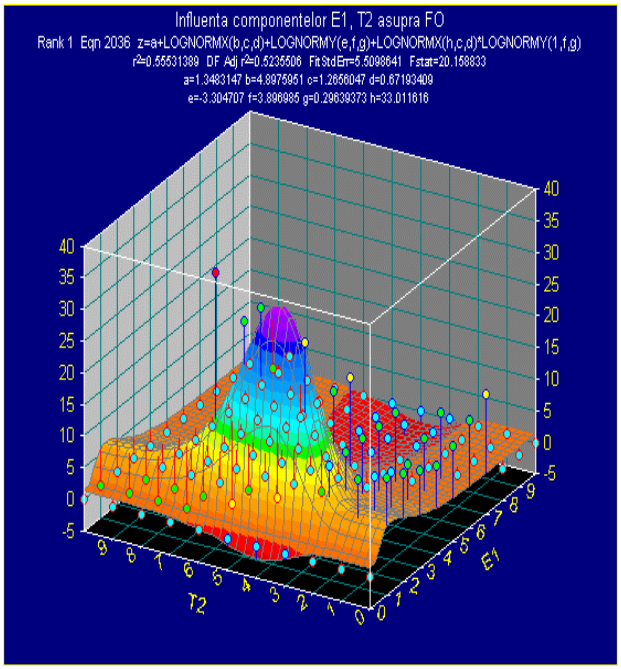


Fig. 11. The cumulated correlation between the criteria function's (CF) prescribed level and $\overline{T}$ and $\overline{E}$ vectors' variation.

The components of two vectors $\overline{T}$ and $\overline{E}$ which are considered to have important weight in the criteria function's evaluation are:

- t_1 – the steels chemical composition;
- t_2 – the steels purity (in gases);
- t_3 – the steels purity (inclusions);
- e_1 – the specific consumption of basic material and materials;
- e_2 – the specific consumption of energy;
- e_3 – the elaboration process's productivity in EAF.

The best level (NO) for each component of the 2 vectors is:

- for t_1 – the prescribed variation limits of the elaborated steel quality composition arithmetical mean.

The cumulated correlation between the criteria function's (C.F.) prescribed levels and $\overline{T}$ and $\overline{E}$ vectors' variation are presented in figure 11.

- for e_1 - the minimum content specific consumption prescribed of basic materials
- for e_2 - the minimum prescribed specific energy consumption.
- for e_3 - the maximum prescribed productivity of the elaboration process.

We can notice the obtaining of:

- the criteria function's maximum level $FO_{T,max} = 43,76$ for the $\overline{T}$ vector's variation (t_1 component - the prescribed variation limits of the elaborated steel quality composition arithmetical mean).
- the criteria function's maximum level $FO_{E,max} = 55,31$ for the $\overline{E}$ vectors' variation (e_3 component - the maximum prescribed productivity of the elaboration process).

And respective the criteria function's maximum level $FO_{CUM,max} = 19,85$ for the $\overline{T}$ and $\overline{E}$ vectors' cumulated variation.

6. Conclusions

From the total polluting emissions of EAF, over 90% are generated during the technological operations of melting and refining.

The gaseous phase (burnt gases) that comes out of the EAF mainly results from the melting and refining procedures and contains carbon monoxide, carbon dioxide together with nitrogen and sulfur oxides (NOx and SOx); however, in practice it also contains very toxic other components, such as fluorides or volatile organic compounds (dioxine, chloride derivatives of benzene or phenol) resulted from burning of organic oils that are introduced as contaminants together with the raw materials.

Fuzzy Logic has been found to be *very suitable for embedded control applications.* Every application can potentially realize some of the *benefits of FL*: *performance, productivity, simplicity and lower cost.*

FL algorithms are implemented as an inference engine which can automatically infer from facts. The application of the fuzzy logic is based on three steps: *fuzzification;* a*ggregation* and *defuzzification.*

Neuro-fuzzy modeling is to use *neural networks* and *fuzzy set theory* to model practical systems. Neuro-fuzzy technology was developed that can automatically extract business rules from the neuro-fuzzy model.

Mathematically, the fuzzy utility function is a more accurate measure on the consumption utility.

The levels of prescribing the criteria function could be obtained by using a composition algorithm for three vectors:

- vector – technical parameters' vector (t_i);
- vector – economical parameters' vector (e_j);
- vector – weight vector (p_k).

The execution of the EAF's charge preheating modelling (CPM) was made both for a 10t EAF and for a 50t EAF.

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