# DETERMINATION OF FUEL CONSUMPTION OF INTERNAL COMBUSTION ENGINE AS A ECOLOGICAL SAFETY FACTOR
## Kondratenko O.M.
### *National University of Civil Defense of Ukraine, Kharkiv*

A promising area of research is the application for assessing the ecological safety level of the exploitation process of power plants with reciprocating ICE of mathematical apparatus of Harrington's generalized desirability function D (see formula (1)) with structure of influencing factors identical to Parsadanov's complex fuel and ecological criterion $K_{fe}$ (see formula (2)). To do this, it is necessary to have data on the ponderability of fuel consumption of ICE $G_f$ as an ecological safety factor [1].

$$D = \sqrt[\sum\limits_{k=1}^{n} \upsilon_k]{\prod_{k=1}^{n} d_k^{\upsilon_k}} = \sqrt[\begin{smallmatrix}\upsilon_{NOx} + \upsilon_{PM} + \\ +\upsilon_{CnHm} + \upsilon_{CO} + \\ +\upsilon_{ge}\end{smallmatrix}]{\begin{aligned}d(g_{NOx})^{\upsilon_{NOx}} \cdot d(g_{PM})^{\upsilon_{PM}} \cdot d(g_{CnHm})^{\upsilon_{CnHm}} \times \\ \times d(g_{CO})^{\upsilon_{CO}} \cdot d(g_e)^{\upsilon_{ge}}\end{aligned}} \qquad (1)$$

$$K_{fe} = \frac{3600 \cdot M_{\kappa p} \cdot n_{\kappa e}}{9550 \cdot H_u \cdot D}; \left|\begin{aligned}&\Sigma = \sum_{k=1}^{h}(A_k \cdot G_k); D = \sigma \cdot \delta \cdot \Sigma + G_f \\ &C = (G_f + 2 \cdot \sigma \cdot \delta \cdot \Sigma)^2 - 2 \cdot (\sigma \cdot \delta \cdot \Sigma)^2\end{aligned}\right| \qquad (2)$$

In the paper proposed the method for determination of ponderability of fuel component of criterion $K_{fe}$ with using of ponderability coefficient $A_{fuel}$ (see formula (3)) which equalizes the formulas for partial derivatives of the criterion with respect to ICE mass hourly fuel consumption $G_f$ (see formula (4)) and to mass hourly emission of $k$th legislative normalized pollutant in ICE exhaust gas flow $G_k$ (see formula (5)).
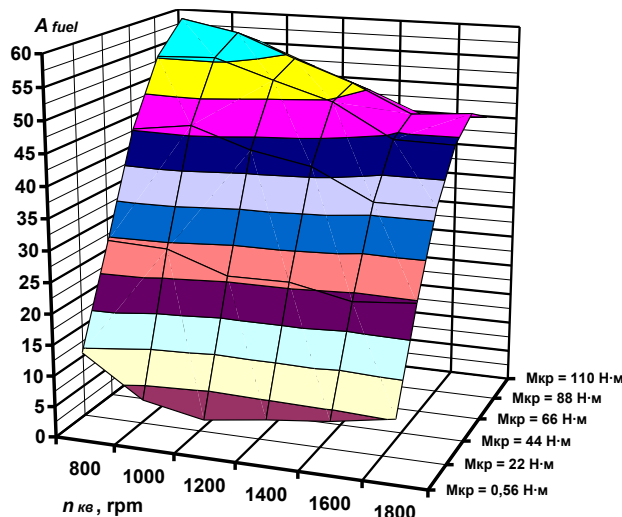


Рис. 1 – Розподіл значень коефіцієнта вагомості $A_{fuel}$ по полю робочих режимів автотракторного дизеля 2Ч10,5/12

$$A_{fuel} = C / (\sigma \cdot \delta \cdot G_f^2) \qquad (3);$$

$$\partial K_{fe} / \partial G_f = -K_{fe} \cdot C / (D \cdot G_{fuel}^2) \qquad (4);$$

$$\partial K_{fe} / \partial G_k = -K_{fe} \cdot \sigma \cdot \delta \cdot A_k / D \qquad (5);$$

The distribution of magnitudes of proposed ponderability coefficient on the operational regimes area of autotractor diesel 2Ch10.5/12 is shown on Fig. 1.

Averaged across the operational regimes area magnitude of proposed ponderability coefficient of fuel component of criterion $K_{fe}$ equals $A_{fuel} = 38{,}4$.

**References:**
1. Vambol S.O., Vambol V.V., Kondratenko O.M. and Mishchenko I.V. (2018). Criteria based assessment of level of ecological safety of process of exploitation of power plants : Monograph, Publ. NUCP of Ukraine, Kharkiv, Ukraine, 320 p.