

## DETERMINATION OF GLOBAL KINETIC PARAMETERS BY OPTIMIZATION PROCEDURE USING BURNING VELOCITY MEASUREMENTS ☆

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**Abstract.** The optimization procedure was developed to derive the global kinetic parameters using experimental dependence of burning velocity on the equivalence ratio. The simple model of laminar premixed flame propagation with assumed constant parameters was used to demonstrate the features of the suggested procedure. The suggested method allows finding optimal parameters for the defined functional dependence of the reaction rate on the temperature and reactant concentrations. The dependence of combustion adiabatic temperature on equivalence ratio is assumed to be known from the flame equilibrium calculations. The global kinetic parameters of combustion reaction were determined for methane, ethylene and propane mixtures with air on the basis of experimental data on burning velocity as function of the equivalence ratio. The calculated overall kinetic parameters are compared with parameters obtained by other methods within similar global model.

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### 1. INTRODUCTION

In spite of the tremendous growth of computer and software capabilities, and the presence of detailed kinetic models for many combustion processes, the use of reduced and global kinetic models still remains very important for fundamental studies and practical applications. The advantage of global and reduced kinetic models is their simplicity, easy use and easy implementation in complex, multidimensional CFD codes, for simulation of combustion processes in complex geometries, etc. On the other hand, the availability of reliable global kinetic data allows one to use the theoretical developments for the analysis of different processes and to make quick estimates of different combustion parameters.

The availability of realistic and accurate chemical models is important for the modeling of real combustors with turbulent flows. The detailed kinetic models are widely used for laminar flames, and for relatively simple

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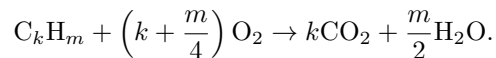
flame configurations. However the computational demands for modeling turbulent flames, combustion in complex configurations of combustion chambers are still, to some extent, impractical with the use of detailed kinetic models. Global and quasi-global reaction schemes provide a practical alternative to the detailed kinetic approach. It should be noted that due to the apparent simplifications of the chemical process, this alternative cannot, obviously, be completely accurate. The simplified and global kinetic models were considered in detail by several authors [1, 2, 7, 8, 15, 26, 27]. Several procedures and methods for deriving global kinetic parameters were suggested and used in [3, 7, 8, 11, 22, 26].

The global kinetic model represents the simplest method to describe the kinetics of combustion reactions. The methods of combustion theory were widely used for the determination of overall kinetic parameters of the reaction rate equation in earlier works [1, 19, 23, 29]. The main experimental combustion processes, which are used for determination of global kinetics are the laminar flame propagation in premixed mixtures (burning velocity, heat release profile, concentration dependencies), ignition (temperature dependence of ignition delay) and high temperature reaction processes in flow-stirred reactors. With the development of detailed kinetic models for many combustion reactions, several approaches were suggested for finding global kinetic parameters using the results of calculations of different combustion parameters (burning velocity, ignition delay, etc) with detailed kinetic descriptions of the reaction.

The aim of this work is to describe the new optimization procedure, which allows one to find a set of global kinetic parameters using experimental measurements of the burning velocity dependence on the equivalence ratio. To this end, we consider the simple model of premixed laminar flame propagation to demonstrate the features of the suggested procedure. We will use the experimental measurements of burning velocity dependencies on the equivalence ratio to derive kinetic parameters. Experimental data for laminar flames of methane, propane and ethylene mixtures with air were analyzed. The derived parameters were compared with available data in literature.

## 2. PROBLEM FORMULATION

A global (or overall) reaction can be written in the following form



The reaction rate is presented in the Arrhenius form with the correction to obey condition that the reaction rate is equal to zero at the initial temperature to avoid problems with infinitesimally small reaction rates at the initial temperatures, as it was discussed by [16, 29],

$$W(Y_f, Y_o, T) = \rho A T^n Y_f^\alpha Y_o^\beta \left[ \exp\left(-\frac{E}{RT}\right) - \exp\left(-\frac{E}{RT_0}\right) \right].$$

Here  $Y_f$ ,  $Y_o$  are mass fractions of fuel and oxidizer respectively;  $T$  is the temperature,  $\rho$  is the overall density of the mixture;  $A$  – preexponential factor,  $n$  – temperature exponent,  $E$  – activation energy,  $\alpha$  and  $\beta$  are reaction orders (or concentration exponents) with respect to fuel and oxidizer,  $R$  is the gas constant;  $\nu = M_o\nu_o/M_f\nu_f$  is the stoichiometric ratio, where  $M_f$ ,  $M_o$  are molecular weights, and  $\nu_f$ ,  $\nu_o$  are stoichiometric coefficients for the reaction:  $\nu_f F + \nu_o O \rightarrow P$ . Initial mass fractions of fuel and oxidizer are determined as follows:  $Y_f^0 = \frac{\phi}{\phi+z}$ ,  $Y_o^0 = \frac{\nu}{\phi+z}$ , where  $\phi = \left(\frac{Y_f}{Y_o}\right) / \left(\frac{Y_f}{Y_o}\right)_{st}$  is equivalence ratio and  $z = \nu \left(1 + 3.762 \frac{M_{N_2}}{M_{O_2}}\right)$ .

The system of energy conservation equation and species continuity equation describing laminar premixed flame propagation in classical formulation reads [19, 21, 29]:

$$\frac{\partial(\rho Y_f)}{\partial t} + \frac{\partial(\rho u Y_f)}{\partial x} = \frac{\partial}{\partial x} \left( \rho D \frac{\partial Y_f}{\partial x} \right) - W(Y_f, Y_o, T),$$

$$\begin{aligned}\frac{\partial(\rho Y_o)}{\partial t} + \frac{\partial(\rho u Y_o)}{\partial x} &= \frac{\partial}{\partial x} \left( \rho D \frac{\partial Y_o}{\partial x} \right) - \nu W(Y_f, Y_o, T), \\ \rho c_p \left( \frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} \right) &= \frac{\partial}{\partial x} \left( \lambda \frac{\partial T}{\partial x} \right) + QW(Y_f, Y_o, T).\end{aligned}$$

To simplify the demonstration of the suggested procedure for finding global kinetic parameters, we will consider the case  $Le = \frac{\lambda}{\rho c_p D} = 1$ . This problem formulation is, to some extent, equivalent to the system considered by Coffee *et al.* [7]. The differences are in the choice of experimental data which are used to derive kinetic parameters, assumed reaction orders, and the optimization procedure. Coffee *et al.* [7, 8] used the flame heat release profile obtained from the calculations with the detailed kinetic model as a fitting parameter to obtain global kinetic parameters. In this work, we directly used the experimental data on burning velocity dependencies on the equivalence ratio.

The burning velocity can be determined by finding stationary solution of the system [29]:

$$\begin{aligned}\rho u &= \text{const} = \rho_1 s_L, \\ \rho_1 s_L \frac{dY_f}{dx} &= \frac{d}{dx} \left( \rho D \frac{dY_f}{dx} \right) - W(Y_f, Y_o, T), \\ \rho_1 s_L \frac{dY_o}{dx} &= \frac{d}{dx} \left( \rho D \frac{dY_o}{dx} \right) - \nu W(Y_f, Y_o, T), \\ \rho_1 c_p s_L \frac{dT}{dx} &= \frac{d}{dx} \left( \lambda \frac{dT}{dx} \right) + QW(Y_f, Y_o, T),\end{aligned}$$

where  $\rho_1$  is the density of initial mixture, and  $s_L$  is the burning velocity.

Boundary conditions are as follows:

$$\begin{aligned}T_x = 0, \quad T = T_0, \quad Y_f = Y_f^0, \quad Y_o = Y_o^0, \quad x = -\infty, \\ T = T_b, \quad T_x = Y_{fx} = Y_{ox} = 0, \quad x = +\infty.\end{aligned}$$

Here,  $T_b$  is adiabatic combustion temperature. Summing up the equations of the system multiplied by the corresponding coefficients, so as to exclude the reaction rate, and then integrating the resulting equations from  $-\infty$  to  $+\infty$ , one can obtain the following linear relations between  $Y_o$ ,  $Y_f$  and  $T$ :  $Y_o - \nu Y_f = Y_o^0 - \nu Y_f^0$ ,  $\theta \equiv T + \frac{Q}{c_p} Y_f = \text{const} = T_0 + \frac{Q}{c_p} \frac{\phi}{\phi+z}$ . These relations allows writing the reaction rate in the following form:

$$W(T) = \rho A T^n \left( \frac{\phi}{\phi+z} - \frac{c_p}{Q} (T - T_0) \right)^\alpha \left( \frac{\nu}{\phi+z} - \frac{\nu c_p}{Q} (T - T_0) \right)^\beta \left[ \exp\left(-\frac{E}{RT}\right) - \exp\left(-\frac{E}{RT_0}\right) \right].$$

Notice that the adiabatic combustion temperature  $T_b = T_0 + \frac{Q \min\{\phi, 1\}}{c_p(\phi+z)}$  is such temperature that either  $Y_f = 0$  or  $Y_o = 0$  depending on lean or rich mixture is considered. Introducing variable  $\xi = \int_0^x \frac{\rho_1 c_p}{\lambda} dx$  and assuming that  $\lambda \rho = \text{const}$ , one can obtain the equation for temperature only [21, p. 44]

$$s_L \frac{dT}{d\xi} = \frac{d^2 T}{d\xi^2} + \frac{Q\lambda}{(\rho_1 c_p)^2} W(T).$$

Thus, finally, the differential equation used for calculation is as follows:

$$\begin{aligned}uT_\xi &= T_{\xi\xi} + U(T), \\ T|_{\xi=-\infty} &= T_0, \quad T_\xi|_{\xi=-\infty} = 0, \quad T|_{x=+\infty} = T_b, \quad T_\xi|_{\xi=+\infty} = 0.\end{aligned}$$

Here,  $U(T) = \frac{Q\lambda}{(\rho_1 c_p)^2} W(T)$ ,  $u$  is the unknown parameter representing burning velocity, which should be determined from the solution. By substitution  $p = T_\xi$  the problem concludes to the equation [16]:

$$\frac{dp}{dT} = u - \frac{U(T)}{p}, \quad (2.1)$$

$$p(T_0) = p(T_b) = 0. \quad (2.2)$$

## 2.1. Adiabatic combustion temperature

One of the key problems of global kinetic parameters obtaining and their further use is the correct determination of equilibrium combustion temperatures. Direct use of the global kinetic model leads to the final products without taking into account their dissociation at high temperatures and, correspondingly, the large overestimate of the final combustion temperature [19, 29]. In this work, we used the combustion temperatures determined directly from the flame equilibrium calculations for the corresponding initial mixture compositions [17]. Thus, the calculated dependencies of adiabatic combustion temperatures on the equivalence ratio were used in the determination of the kinetic parameters. To some extent the approach of Coffee *et al.* [7] in the use of the calculated flame heat release profiles from detailed kinetic models is similar to our approach in the determination of the level of combustion temperatures.

## 3. OPTIMIZATION PROCEDURE FOR DERIVING GLOBAL KINETIC PARAMETERS. MATHEMATICAL METHOD

The problem concludes to finding of unknown parameters of the reaction rate function,  $X = (A, E, \alpha, \beta, n)$ , using experimental data obtained at several values of the equivalence ratio,  $\phi$  (different mixture compositions). Let us formulate problem of optimization using the method of least squares:

$$f(X) = \frac{1}{2} \sum_{j=1}^m (u(X, \phi_j) - u_j)^2 \rightarrow \min.$$

Here  $u(X, \phi)$  is the burning velocity corresponding to the vector of unknown parameters,  $X$ , and to the set of experimental values of burning velocity,  $u_j$ ,  $j = 1, \dots, m$ , at the corresponding values of the equivalent ratio,  $\phi_j$ . In addition to burning velocity data, the dependence of adiabatic combustion temperature on the equivalence ratio,  $T_b(\phi)$ , is provided. The parameter  $\frac{Q}{c_p}$  is calculated by the formula  $\frac{Q}{c_p} = (T_b(\phi) - T_0) \frac{\phi + z}{\min\{\phi, 1\}}$ .

### 3.1. Determination of burning velocity

By substituting  $y = p^2$ , one can transform equations (2.1) and (2.2),

$$\frac{dy}{dT} = 2u\sqrt{y} - 2U(T), \quad (3.1)$$

$$y(T_0) = y(T_b) = 0. \quad (3.2)$$

Note, that function  $U(T)$  depends on parameters  $X = (A, E, \alpha, \beta, n)$  and  $\phi$ . This function  $U$  includes also  $Q/c_p$ , which is related with adiabatic temperature  $T_b$ . The functional dependency  $T_b$  on the  $\phi$  is taken from calculations for the corresponding initial mixture compositions [17]. To find a solution for the problem (3.1), (3.2) at a given  $u$  we will use the trapezoid method:

$$\frac{y_{i+1} - y_i}{h} = u\sqrt{y_i} + u\sqrt{y_{i+1}} - U(T_i) - U(T_{i+1}), \quad y_0 = 0.$$

or

$$\frac{p_{i+1}^2 - p_i^2}{h} = up_i + up_{i+1} - U(T_i) - U(T_{i+1}), \quad p_0 = 0,$$

where  $h$  is the integration step.

The quadratic equation was obtained relative to  $p_{i+1}$ , which solution is as follows:

$$p_{i+1} = \frac{h}{2}(u + \sqrt{D}), \quad D = u^2 + \frac{4}{h} \left( \frac{p_i^2}{h} + up_i - U(T_i) - U(T_{i+1}) \right).$$

At  $i = 0$  the number  $p_1$  can be determined from the equation:

$$p_1 = p(T_0 + h) = \left( \frac{u}{2} + \sqrt{\frac{u^2}{4} - \frac{U(T_{i+1})}{h}} \right) h.$$

This is in agreement with the relationship obtained in [16]:

$$p(T_0 + h) \approx \left( \frac{u}{2} + \sqrt{\frac{u^2}{4} - U'(T_0)} \right) h, \quad h \approx 0.$$

Thus we need to find the burning velocity at which  $p(T_b) = 0$ . Note that with the increase of  $u$  the solution of (3.1), (3.2) increases for the whole range of  $T$  values. As a result we will use the bisection method for the calculation of burning velocity. Numerical experiments demonstrate that the solution becomes equal to 0 at  $T < T_b$  (solution is “going down”), or it is not equal 0 until  $T = T_b$  (solution is “going up”). The bisection procedure allows one to find  $u_1, u_2$  for any  $\varepsilon$ , so  $0 < u_2 - u_1 < \varepsilon$  and at  $u = u_1$  solution is going down, and at  $u = u_2$  the solution is going up. The solution, burning velocity, is in  $(u_1, u_2)$  interval of burning velocity values.

### 3.2. Optimization procedure

The effectiveness of optimization algorithms depends on many factors, and, first among them, on the properties of the function to be optimized, and the constraints. Analysis of level lines of the surface function  $f$  as a function of two variables (at the constant values for the other 3 parameters) indicates that  $f$  is strictly convex for the range of possible values. Figure 1 contains a typical example of level lines of the function  $f$  depending on the parameters  $\alpha, \beta$ . It demonstrates the unimodality of the function  $f$ . The property of strict convexity provides the uniqueness of the solution for finding of the unknown parameters of the model by the suggested method and determines the choice of the optimization procedure.

For the minimization we will use a modification of the Gauss–Newton algorithm. Shortcomings of the classical Newton method are related to the calculation and inversion of matrices of second derivatives. This leads to an increase of the computation time, but more importantly there may be significant computational errors if the matrix of second derivatives turns out to be poorly conditioned. The algorithm suggested below doesn't require the inversions of Hessians. Its application provides a much higher convergence rate than using other modifications of the method of steepest descent.

To solve the problem  $f(X) \rightarrow \min$ , we will use the gradient descent method with a variable metric:

$$X_i^{k+1} = X_i^k - \frac{\lambda_k}{d_i} \frac{\partial f(X^k)}{\partial X_i}.$$

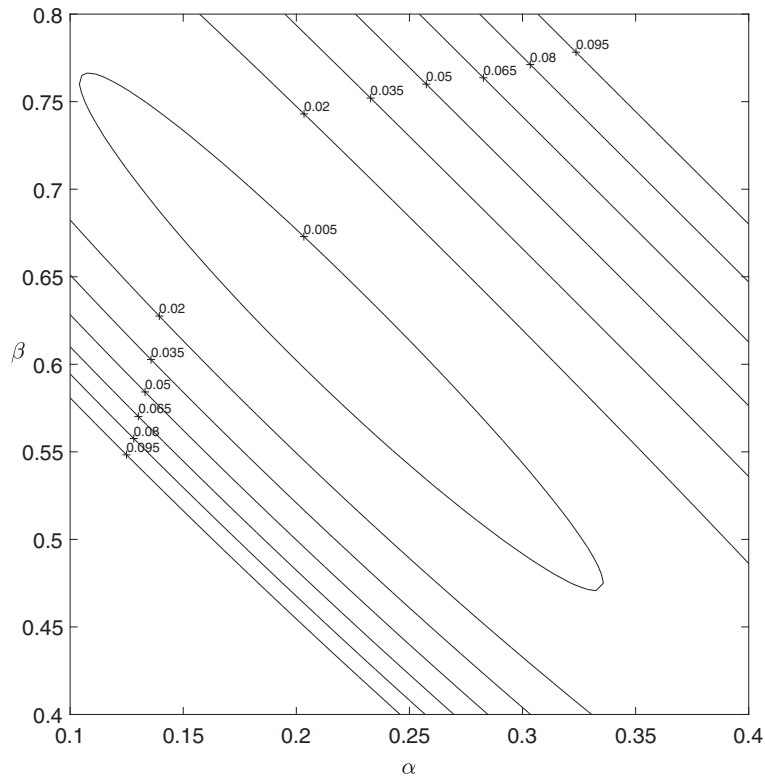


FIGURE 1. Level lines of the function  $f$  as a function of the parameters  $\alpha, \beta$  assuming the other parameters are constants. The figure corresponds to the neighborhood of the optimal parameters calculated for methane/air mixture, experimental data [24].

Here,

$$\frac{\partial f(X)}{\partial X_i} = \sum_{j=1}^m (u(X, \phi_j) - u_j) \frac{\partial u(X, \phi_j)}{\partial X_i}, \quad \frac{\partial^2 f(X)}{\partial X_i^2} \approx d_i = \sum_{j=1}^m \left( \frac{\partial u(X, \phi_j)}{\partial X_i} \right)^2.$$

Derivatives,  $\partial u(X, \phi_j)/\partial X_i$ , are calculated using finite differences. The step size  $\lambda_k$  of the gradient method is variable: if the value of function  $f(X)$  on the next step is larger than the value on the previous one, the step was decreased twice. The step was increased twice if after 3 steps the value of function was decreasing. The suggested procedure was realized in the program available on the web: <https://github.com/grenkin/flame-speed>.

#### 4. EXAMPLES AND DISCUSSION

Below we consider several examples of determination of global kinetic parameters using burning velocity measurements of different authors for methane [4, 24, 25, 28], ethylene [9, 13, 14] and propane [24, 25]. The used dependencies of burning velocity on the equivalence ratios were measured by different experimental techniques, and are in overall agreement between the experimental measurements. For methane combustion, data came from [4, 24, 25]. Vagelopoulos *et al.* [24] used the counterflow, twin-flame technique and laser-Doppler velocimetry for the determination of laminar flame speed. In the work, Vagelopoulos *et al.* [25] suggested an improved experimental method for direct measurement of burning velocity. In brief, it is based on the use of the stagnation flow configuration and large separation distances between the nozzle and the stagnation plane. This allows the

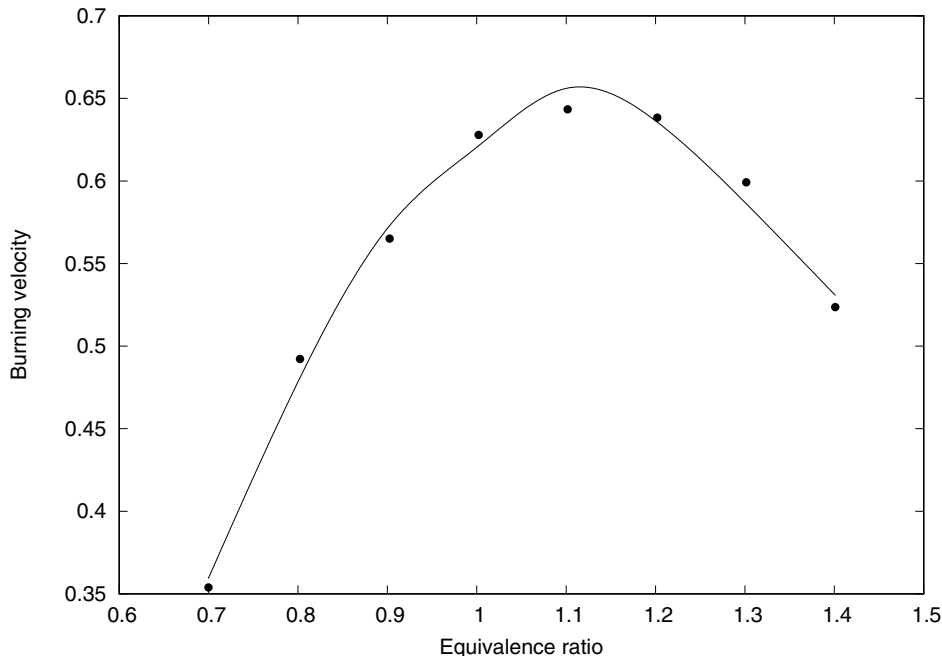


FIGURE 2. Burning velocity dependence on the equivalence ratio for ethylene-air flame (experimental data [14], line – calculations with the of obtained global parameters, Tab. 1).

establishment of Bunsen-type flames. The flow velocities were measured by the laser Doppler technique. Their measurements can possibly be considered as the most accurate measurements of burning velocity at present time. Bosschaart and de Goey [4] applied the relatively rarely used heat flux method for measurements of methane burning velocities. Burning velocity of ethylene/air mixtures, analyzed in our work, was registered in the wide range of stoichiometries, pressures and flame temperatures using the counterflow method [9]. Hassan *et al.* [13] used spherical outwardly propagating flames in spherical constant volume chamber to determine burning velocity of ethylene. The propagation of the flame surface was registered by high speed motion picture shadowgraphy. Dual-chamber design was employed by Jomaas *et al.* [14] to derive the burning velocity of outwardly propagating flame of ethylene/air mixtures. Dual-chamber configuration allows one to analyze processes at approximately constant pressure. The propagation sequence was recorded using schlieren imaging and a high-speed digital camera. The experimental data for burning velocity of propane/air mixtures [24, 25] were obtained by the techniques indicated above.

Calculations were performed for  $T_0 = 298$  K and  $D = 2.5 \times 10^{-5}$  m<sup>2</sup>/s. Figure 2 contains results of experimental measurements of burning velocity dependence on the equivalence ratio for ethylene combustion [14] and the resulting dependence obtained with the calculation of determined global kinetic parameters based on the measurements of this work. Table 1 contains the calculated global kinetic parameters for different measurements of burning velocity dependence for methane, ethylene and propane [4, 9, 13, 14, 24, 25, 28] along with the results of determinations of other authors [5, 6, 10–12, 18, 20, 23, 26] for comparison purposes. The root-mean-square deviation is defined by the formula  $\sigma = \left( \frac{1}{m} \sum_{j=1}^m (u(X, \phi_j) - u_j)^2 \right)^{1/2}$ .

The obtained results (Tab. 1) demonstrate that the calculated global kinetic parameters for the analyzed experimental results [4, 9, 13, 14, 24, 25, 28] describe reasonably well the experimental results in the range of equivalence ratios studied in these works. Thus the kinetic models based on the calculated global kinetic parameters should be reasonably good in reproducing burning velocities for lean and rich mixtures of methane, ethylene and propane. It is of interest to indicate that the experimental results obtained by different authors

TABLE 1. Global kinetic models (one stage-reaction presentation;  $d[f]/dt = -AT^a \exp(-E/RT)[f]^b[\text{O}_2]^c$ )

Fuel	$A$	$a$	$b$	$c$	$E/R$	$\sigma$	Reference
CH <sub>4</sub>	2.03e9	0.517	0.216	0.619	31 320	0.019	This work, experiment [24]
CH <sub>4</sub>	5.35e9	0.665	0.394	1.14	29 920	0.024	This work, experiment [25]
CH <sub>4</sub>	3.42e9	0.571	0.462	0.823	29 360	0.017	This work, experiment [4]
CH <sub>4</sub>	4.95e8	0.257	0.140	0.530	26 000	0.018	This work, experiment [28]
CH <sub>4</sub>	7.0e8	-1	-0.5	1.5	30 190		[18]
CH <sub>4</sub>	6.0e8	0	-0.4	1.4	28 680		[20]
CH <sub>4</sub>	3.0e13	0	0.7	0.8	23 650		[5]
CH <sub>4</sub>	1.3e8	0	-0.3	1.3	24 360		[26]
CH <sub>4</sub>	8.3e5	0	-0.3	1.3	15 100		[26]
CH <sub>4</sub>	2.5e12	0	0.2	1.3	24 510		[6]
CH <sub>4</sub>	6.9e14	0	1	1	15 900		[11]
C <sub>2</sub> H <sub>4</sub>	2.42e8	0.126	0.11	0.243	24 220	0.032	This work, experiment [13]
C <sub>2</sub> H <sub>4</sub>	2.84e8	0.132	0.268	0.437	21 590	0.030	This work, experiment [9]
C <sub>2</sub> H <sub>4</sub>	3.37e7	-0.226	0.052	0.022	17 010	0.009	This work, experiment [14]
C <sub>2</sub> H <sub>4</sub>					18 120		[10]
C <sub>2</sub> H <sub>4</sub>	2.0e12	0	0.1	1.65	15 100		[26]
C <sub>3</sub> H <sub>8</sub>	3.64e8	0.159	0.402	0.646	20 870	0.010	This work, experiment [24]
C <sub>3</sub> H <sub>8</sub>	1.03e9	0.351	0.413	0.869	24 000	0.023	This work, experiment [25]
C <sub>3</sub> H <sub>8</sub>	8.6e11	0	0.1	1.65	15 100		[26]
C <sub>3</sub> H <sub>8</sub>	3.3e9	0	1	0	19 120		[12]
C <sub>3</sub> H <sub>8</sub>	4.2e11	0	1	0	29 700		[23]

[4, 24, 25, 28] for burning velocity of methane flames are in reasonable agreement (as well as comparison for C<sub>2</sub>H<sub>4</sub> and C<sub>3</sub>H<sub>8</sub>), the determined global parameters differs, to some extent, significantly. Nevertheless the calculated parameters are able to provide agreement with experimental data indicating the “relative insensitivity” of burning velocity to the values of kinetic parameters of the model. These results also demonstrate that the optimization procedure in the application to the model (2.1), (2.2) of laminar premixed flame propagation can lead to a relatively large scatter in the global kinetic parameters for relatively close experimental data. Comparison of our results with others [5, 6, 10–12, 18, 20, 23, 26] also shows relatively large discrepancies. Note that the cited global kinetic parameters found in [5, 6, 10–12, 18, 20, 23, 26] might not be accurate for the whole range of equivalence ratios as it was discussed by Coffee *et al.* [6].

## 5. CONCLUSIONS

In this work, we have suggested a new procedure for the determination of global kinetic parameters based on the optimization method with the use of experimental dependence of burning velocity on the equivalence ratio. We demonstrate the application of the suggested procedure using the classical model of laminar premixed flame propagation, assuming Lewis number,  $Le = 1$ , and assuming other parameters of the model independent on temperature and mixture composition.

It is of interest to indicate that the global (or overall) kinetic models represent an approximate description of the reaction proceeding. It is the model obtained from the “fitting” procedure. Its application for different temperatures, extrapolation to different combustion processes (*e.g.* ignition, detonation) or for the calculation of other combustion parameters can lead to incorrect results. Global reactions are not “independent”, as elementary reactions. The values of global kinetic parameters depend on the combustion mode used, initial conditions, on the experimental parameter used to derive kinetic data, and, of course, on the presentation of the overall kinetic process. Combining several global kinetic models to describe a more complex process does not guarantee



satisfactory results. The application of overall kinetic models to predict intermediate stable compounds or profile of heat release rate requires special considerations.

However, as discussed before, the simplicity and easy implementation of global kinetic models is the key advantage of this type of kinetic models. The main results of this work are as follows:

1. A new procedure was developed for the estimation of global kinetic parameters of combustion reactions using the optimization method and experimental dependencies of burning velocity on the equivalence ratio.
2. The calculation procedure for deriving global kinetic parameters was developed in the frames of a simple model for laminar premixed flames assuming  $Le = 1$  and temperature independent and constant parameters of the model.
3. The suggested procedure was used for the determination of global kinetic parameters for methane, ethylene and propane laminar premixed flames in air.
4. Results of our calculations demonstrate that it was possible to obtain one set of global kinetic parameters for the range of equivalence ratios to describe experimental data obtained in the analyzed works.
5. Calculations show relative insensitivity of derived parameters to the measured burning velocity data.

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