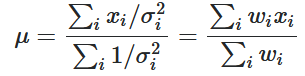
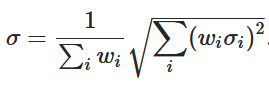
Following the re-evaluation of H+O2+M reaction rate (reference), we carried out the uncertainty assessment of all reactions in H2-O2 reaction system using statistical inference. The whole processes can be divided into a few steps:

1. Collect all available experimental kinetics data of each reaction. Different from others, we only use the data from the shock tubes and flow reactors that provides time history profiles of key speciation considering ignition delays, flame speed, jet stirred reactor etc experimental are more of global measurement and the values drived from them have much higher uncertainty because of much stronger interference from other reactions, temperature/pressure variations, or even molecular transport parameters.
2. The reaction at each temperature/pressure were evaluated using weighted average (maximum likelihood function) which values more accurate experimental measurements. The mathematical formula can be expressed as the following with ( stand for the measurement value, the uncertainty of the measurement/evaluated value, the weight of the corresponding value used the evaluation, and final evaluated value







1. With the evaluated rates and the corresponding uncertainties, a weighted least square fitting are used to derive the Arrhenius parameter and their uncertainty which again emphasize more the more accurate data. The uncertainties of Arrhenius parameters are derived from the covariance matrix the correlation between each are not significant. Monte Carlo simulations were employed if the correlations are so big that the uncertainty cant be easily quantified.
2. A new mechanism was then composed of reactions in Arrhenius format with uncertainty attached.
3. An iterative process is used to refine the parameters by fitting the shock tube and flow reactor kinetics experiments with least square fitting
4. The advantage of this evaluation process over others can be summarized here:
   1. More accurate collection of experimental data, less affected by the global measurement
   2. Robust statistical inference foundation, more objective and free of personal preference
   3. Automated evolve with new experimental data adding in

H2\_O2 reaction in four categories:

1. Important reactions and accurate measurements. Fully statistical inference from experiments on rate evaluation

H + O2 = O + OH

H2 + OH = H2O + H

H2 + O = OH + H

OH + OH = H2O + O

1. HO2 and H2O2 related. Very important in high pressure combustion but less accurate measurement. Include theoretical calculation to guide the evaluation

HO2 + H = OH + OH

HO2 + H = O + H2O

HO2 + H = H2 + O2

HO2 + OH = H2O + O2

HO2 + O = O2 + OH

HO2 + HO2 = H2O2 + O2

H2O2 + H = H2 + HO2

H2O2 + H = OH + H2O

H2O2 + O = OH + HO2

H2O2 + OH = HO2 + H2O

1. Important pressure dependent rates many measurement. Evaluate the Troe formula using high pressure limit rate from high level theory to obtain the low pressure limit rate expression and pressure broadening factor

H+O2+M =HO2+M

H+OH+M =H2O +M

H2O2+M = OH+OH+M

1. Not very important reactions and just use to complete the mechanism. Add simple theoretical estimation to improve accuracy

O + O + M = O2 + M

O + H + M = OH + M

H + H + M = H2 + M