International Atomic Energy Agency

Evaluation: Least Squares (Exercise)

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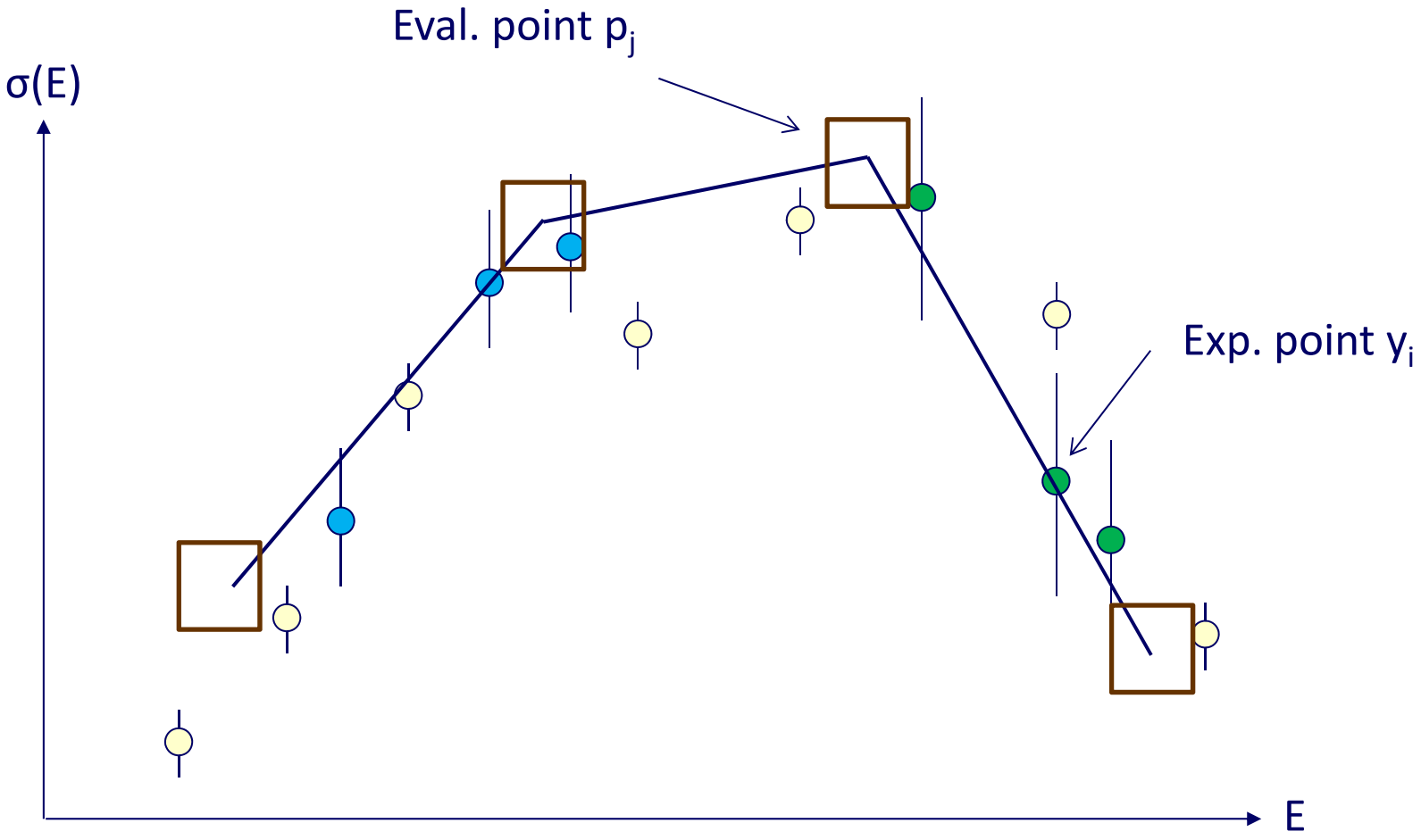
Evaluation of Excitation Function



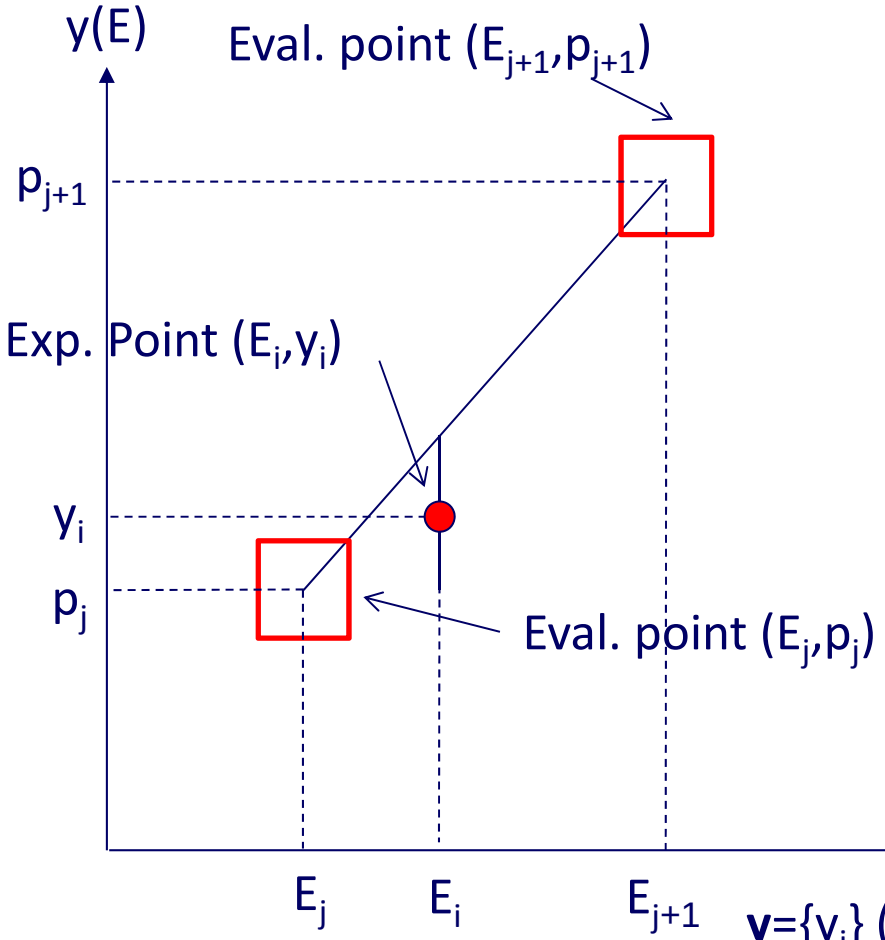
SOK (Simultaneous Evaluation on Kalman)

- Developed by Toshihiko Kawano for simultaneous evaluation of ^{233,235,238}U and ^{239,240,241}Pu(n,f) for JENDL-3.3.
- Also adopted by NO for simultaneous evaluation for JENDL-4.0.

References:

- T.Kawano et al., J.Nucl.Sci.Technol.37(2000)327.
- T.Kawano et al., JAERI-Reseasrch 2000-004 (2000).

Evaluation of Excitation Function



Fitting model adopted in SOK

$y_i \sim p_j + [(p_{j+1}-p_j)/(E_{j+1}-E_j)]\cdot(E_i-E_j)$

$= (E_{j+1}-E_i)/(E_{j+1}-E_j)p_j$

$+ (E_i-E_j)/(E_{j+1}-E_j)p_{j+1}$

This is a linear combination of p_j and p_{j+1}. Therefore fitting function is described as

$y \sim f(p)=Gp$

y=$\{y_i\}$ (i=1,n): Experimental data

p=$\{p_j\}$ (j=1,m): Evaluated data

Generalized Least Squares in SOK

The matrix becomes very large if we solve the equations

$$\mathbf{p}=\mathbf{p}_0+\mathbf{M}_0\mathbf{G}^t(\mathbf{G}\mathbf{M}_0\mathbf{G}^t+\mathbf{V})^{-1}(\mathbf{y}-\mathbf{y}_0)$$
$$\mathbf{M}=\mathbf{M}_0-\mathbf{M}_0\mathbf{G}^t(\mathbf{G}\mathbf{M}_0\mathbf{G}^t+\mathbf{V})^{-1}\mathbf{G}\mathbf{M}_0$$

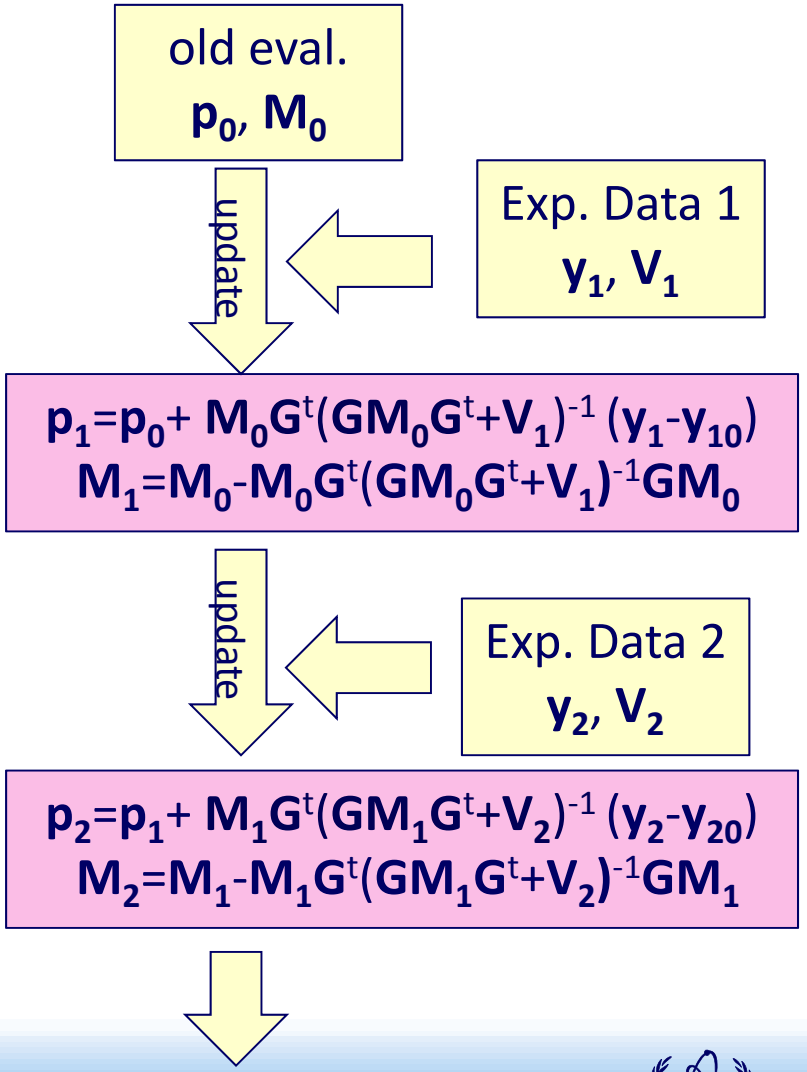
for all n experimental data points .

SOK update p for each experimental data set step by step, i.e.,

$\mathbf{p}_0 \rightarrow \mathbf{p}_1$, $\mathbf{M}_0 \rightarrow \mathbf{M}_1$ by exp. data set 1

$\mathbf{p}_1 \rightarrow \mathbf{p}_2$, $\mathbf{M}_1 \rightarrow \mathbf{M}_2$ by exp. data set 2

…



Exercise (~18:00)

1. Copy SOK related files from subdirectory sok of ftp://napc-ftp-ext:qu6uvASWeW4Jasw@ftp.iaea.org/ws2013/.
2. Read “readme.txt”
3. Run SOK with sample input.
4. Choose reaction/energy range for your evaluation.
   (e.g., from LEXFOR - Dosimetry Neutron Reaction Data).
7. Prior data can be taken from an existing evaluated data set.
8. Covariance matrix for input can be generated by “cov” button of the EXFOR web retrieval system.
8. Number of data point evaluated by you must be less than the total number of experimental data points!