Comparison of Adjustment Methodologies

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Discussion Points

- Fundamental theory and Basic equation to adjust differential data and covariances?

- Unique features?
Typical References related to Adjustment Study since 1964


# Comparison of Adjustment Equations

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<tr>
<th>Organization</th>
<th>Theory</th>
<th>Basic equation</th>
<th>Reference</th>
<th>Major unique feature</th>
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<td><strong>INL</strong> (USA)</td>
<td>Lagrange multiplier’s method</td>
<td>$\tilde{y} - y = -(I - B_y A^T G^{-1} A)v$</td>
<td>Gandini, “AMARA”, 1973</td>
<td>Limit the number of adjusted parameters. $</td>
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<td>$B_y = (I - B_y A^T G^{-1} A)B_y (I - B_y A^T G^{-1} A)^T$</td>
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<td><strong>JSI</strong> (Slovenia)</td>
<td>Partitioned least-square method</td>
<td>ZOTT-99 code</td>
<td>Muir, NSE 101, 1989</td>
<td>Modify input covariances to enforce unit $\chi^2$.</td>
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<td><strong>IPPE</strong> (Russia)</td>
<td>Maximum likelihood method</td>
<td>$C' - C = WH^T (V + WHW^T)^{-1} (I - I_p)$</td>
<td>Manturov, “INDECS”, 1984</td>
<td>Check of data consistency. $1 - STD \geq \left</td>
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<td>$W' = W - WH^T (V + WHW^T)^{-1} HW$</td>
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<td><strong>JAEA</strong> (Japan)</td>
<td>Baysian parameter-estimation method</td>
<td>$T' = T_0 + MG'[GGM' + V_e + V_m]'[R_e - R_e(T_0)]$</td>
<td>Dragt, NSE 62, 1977</td>
<td>Include the Vm explicitly.</td>
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<td>$M' = M - MG'[GGM' + V_e + V_m]'GM$</td>
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<td><strong>CEA</strong> (France)</td>
<td>Bayes’ theorem method</td>
<td>$\tilde{\sigma} - \tilde{\sigma}<em>m = M</em>\sigma \cdot S^T (M_K + S \cdot M_\sigma \cdot S^T)^{-1} (\tilde{E} - \tilde{C}(\sigma_m))$</td>
<td>Gandini, Symposium, Tokyo, 1973</td>
<td>Applied to ERALIB1.</td>
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</tbody>
</table>
Concluding Remarks

- Fundamental theory and Basic equation.
  - Four organizations (JSI, IPPE, JAEA and CEA) applies the identical equations,
  - The equations of INL seems mathematically identical with above, and,
  - The total Monte Carlo method by NRG is an alternative way to propagate uncertainties, so the essential results are expected equivalent with others.

- Unique features among them.
  - INL seems to like limiting the number of adjusted parameters, but what is the motivation?,
  - JSI modifies the input covariances to enforce unit $\chi^2$, but the actual procedure such as the change of diagonal elements is persuasive?
  - IPPE checks the data consistency with the range of $\left|\sqrt{\frac{\chi^2}{N}} - 1\right|$, but what is the reason of one STD as criteria?
  - JAEA would like to make the consensus on the need of Vm in SG33 activity,
  - TMC approach of NRG is quite unique, but the balance of cost and benefit?
  - CEA has already opened the adjusted library ERALIB1, but was it accepted in the industry or authority? Are there room for improvement?