Figures concerning the example of Gauss for the least-squares method

Notations
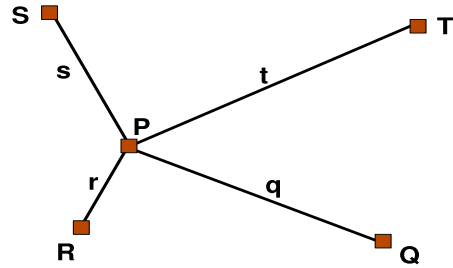
$$
\begin{aligned}
S &= \text{Ammensen} \\
T &= \text{Brocken} \\
Q &= \text{meridian mark (Wehnder paper mill)} \\
R &= \text{Hohenhagen} \\
P &= \text{observatory in Göttingen}
\end{aligned}
$$
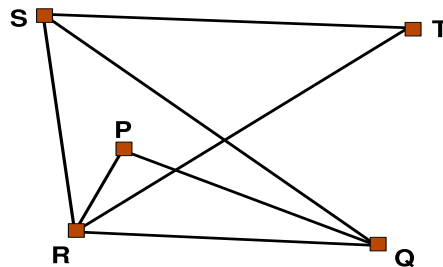
heigth measurements carried out by Gauß: 1. measured heigth-differences

Relative measurements

$$
\begin{aligned}
Q &= P + 66.334 \\
R &= P + 349.366 \\
R &= Q + 283.596 \\
S &= Q + 206.580 \\
S &= R - 76.108 \\
T &= R + 648.427 \\
T &= S + 719.612
\end{aligned}
$$

heigth measurements carried out by Gauß: 2. heigth-differences with reference P

Taking the observatory as reference point and defining the relative height differences

$$q := Q - P \ , \ \ r := R - P \ , \ \ s := S - P \ , \ \ t := T - P$$

gives

$$
\begin{pmatrix}
1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
-1 & 1 & 0 & 0 \\
-1 & 0 & 1 & 0 \\
0 & -1 & 1 & 0 \\
0 & -1 & 0 & 1 \\
0 & 0 & -1 & 1
\end{pmatrix}
\begin{pmatrix}
q \\ r \\ s \\ t
\end{pmatrix}
=
\begin{pmatrix}
64.334 \\
349.366 \\
283.596 \\
206.580 \\
-76.108 \\
648.427 \\
719.612
\end{pmatrix} .
$$