Manual Linear Regression for CBI-CME Velocity Analysis

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Original Data, No Zeros

The slope m and intercept b of the best-fit line are given by:

$$m = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} = \frac{-0.04}{1.09 \times 10^{-10}} = -361{,}169{,}714.05$$

$$b = \bar{y} - m\bar{x} = 727.764 - (-361{,}169{,}714.05)(6.08 \times 10^{-7}) = 947.50$$

The correlation coefficient r is:

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \cdot \sum(y_i - \bar{y})^2}} = \frac{-0.04}{\sqrt{(1.09 \times 10^{-10})(1.54 \times 10^{8})}} = -0.30$$

Results

- Slope: $m = -361{,}169{,}714.05$
- Intercept: $b = 947.50$
- Correlation coefficient: $r = -0.31$

180° Position Angle Shift From Original Data, No Zeros

The slope m and intercept b are calculated as:

$$m = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} = \frac{-0.005}{5.40 \times 10^{-11}} = -105{,}969{,}191.42$$

$$b = \bar{y} - m\bar{x} = 727.76 - (-105{,}969{,}191.42)(4.55 \times 10^{-7}) = 775.98$$

The correlation coefficient is:

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \cdot \sum(y_i - \bar{y})^2}} = \frac{-0.005}{\sqrt{(5.40 \times 10^{-11})(1.54 \times 10^{8})}} = -0.06$$

Results

- Slope: $m = -105{,}969{,}191.42$
- Intercept: $b = 775.98$
- Correlation coefficient: $r = -0.06$