Acceleration of Gravity

I ran the model with over 20 different position vectors, but will present results from one of them. Results were not obviously different between the different tests.

$g = 10.2902$

C_d and C_m

C_d is a square matrix of size NxN where $N =$ number of position points, symmetrical about the diagonal with only positive values along the diagonal, consistent with expected properties of covariance.

C_m is also square matrix of size mxm where $m =$ number of model paremeters. Although I expect C_m to also be symmetrical about the diagonal with only positive values along the diagonal, this is not the case. I believe this is due to G^{-g} being "near-singular" for the tests I have run.

$\hat{\mathbf{m}}_5$

The model $\hat{\mathrm{m}}_5$ weighted by the C_d co-variance matrix is essentially identical in parameter values to the model $\hat{\mathrm{m}}_1$.

χ^2 Test

The χ^2 test also had peculiar results that were hard to interpret. Using the individual variances of each point (i.e. the diagonal values of C_d) as the denominator led to $\chi^2 = N$ value equal to N. Using the variance of all of the residuals as the denominator led to a $\chi^2 = N - 1$. In my case, $N = 20$. I am not certain which value is correct, but the phenomena puzzles me. Oddly, calculating residuals using an arbitrary function, such as $error = d(t) - sin(t)$ or $error = d(t) - t$ led to reasonable χ^2 values of about 23, and only extremes such as $error = d(t) - rand$ were clearly rejected. There seems to be a peculiar circular logic to scaling residuals by their relative length, such that continuous functions with nearby values are not easily rejected by the χ^2 test.

Confidence Intervals

My 95% confidence intervals for model parameters were extremely small: For m_1, $0.0144e-08$, for m_2, $0.0694e-08$, for m_3, $0.1725e-08$. Significantly, due to the issues with C_m not always being positive on the diagonal and not being symmetric, I suspect that singularity in the inversion process also skewed these results.

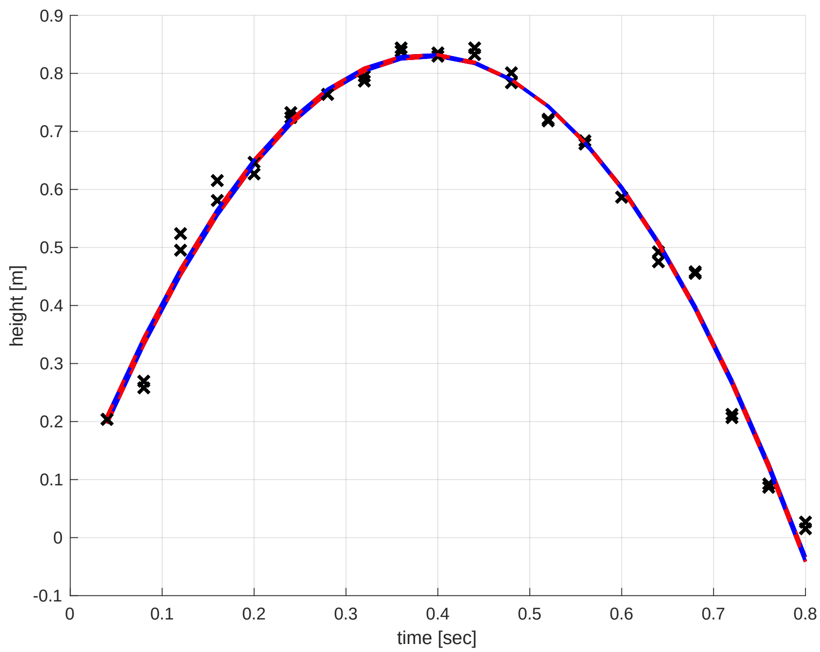

Figure 1: The two (indistinguishable) models fit to a set of height points.