# Envelope of GSFR results:

## Part 1: Variables with Inaccuracy

Based on the 5th edition of Modern Control Engineering, the following variables were given a normal distribution, with Mean and Standard Deviation from the book.

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Description automatically generated

The book did not mention a range for K or D (Mechanical Gain Power and Damping factor respectively), dismissing them as not having a large influence on the outcome of the GSFR results.

In this report, a Correction Factor of 1 was used, but see GitHub repository for several other correction factors ranging from 0.1 to 1.

## Part 2: Code

All code has been submitted to GitHub for version control, and can be found at the following link:

<https://github.com/TheOneRui/IndividualProject>

Monte Carlo simulation files can be found in (**Current Working Files \ Monte Carlo**)

The code has been designed to generate folders which store results from each run, in the form of a matlab figure, a matlab cell array (with time series and input variables), a png of the matlab figure, and a png of the Compensating Power Injection.

(The code does feature some, unnecessary, Quality of Life features)

## Part 3: Ideal Injection

### 250 Runs:

A graph of a graph showing a number of numbers

Description automatically generated with medium confidence

*Black dotted line is Original GSFR, solid Black line is Mean GSFR with Ideal Injection*

### 10000 runs:

A screen shot of a graph

Description automatically generated

*Black dotted line is Original GSFR, solid Black line is Mean GSFR with Ideal Injection*

## Part 4: Simplified Injection

Simplified injection is defined in this report as an injection based on the Max value of the Ideal injection, and the final value of the Ideal Injection, with a constant slope in between.

### Ideal Injection vs Simplified:

A graph showing the value of a number

Description automatically generated with medium confidence

Figure 1: Ideal Injection

A graph showing the value of a point

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Figure 2: Simplified Injection

### 1000 Runs:

A graph showing a wave of a person

Description automatically generated with medium confidence

## Part 4: Halved Injection

Halved injection is defined in this report as an injection based on the Max value of the Ideal injection, and the start of the second triangular injection, with a constant slope. If the start of the second triangular injection correlates to a negative value of Active Power, a value of 0 is used instead. If the start of the second triangular injection correlates with a positive value, then the new injection will use that positive value in finding the slope and will continue to decrease until Active Power is equal to 0.

Based on the above definition, the halved injection is identical to the simplified injection for B (Correction Factor) = 1, so for demonstration of the difference, B is set to 0.8 for this example. (**See Simplified for the GSFR results for Halved**, as they are identical).

### Ideal Injection vs Halved:

A graph of a graph

Description automatically generated

Figure 3: Ideal Injection

A graph of a power injection

Description automatically generated

Figure 4: Halved Injection

### 1000 Runs:

A graph of a graph showing a number of numbers

Description automatically generated with medium confidence