

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.

```
%Randomize the Variables by Normal Distribution
R = (0.05/3)*randn()+0.075;
H = 1.17*randn()+5.5; %mean of 5.5 with dev 1.17
K = 0.95;
Fh = 0.034*randn()+0.25;
Tr = 0.67*randn()+9;
D = 1.0;
```

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>

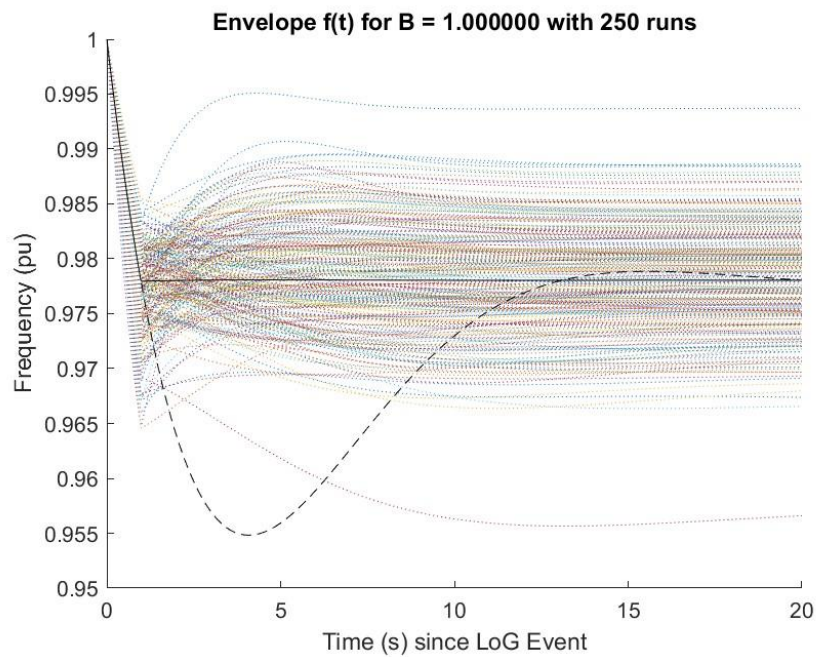
Monte Carlo simulation files can be found in (**Current Working Files \ Monte Carlo**)

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)

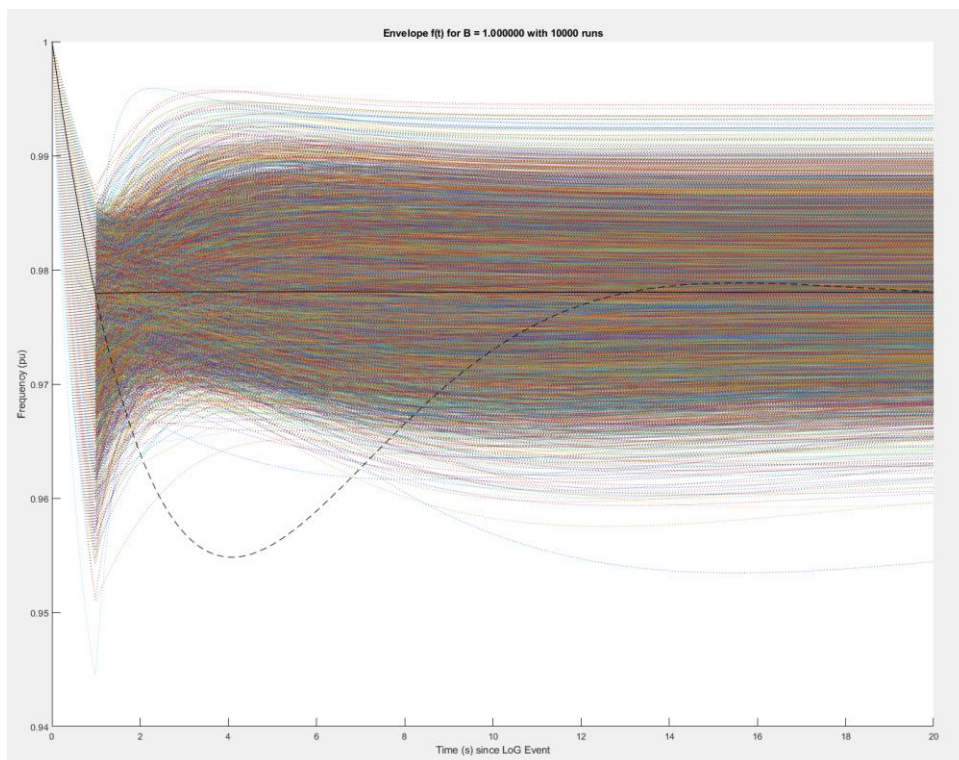
Part 3: Ideal Injection

250 Runs:



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

10000 runs:



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:

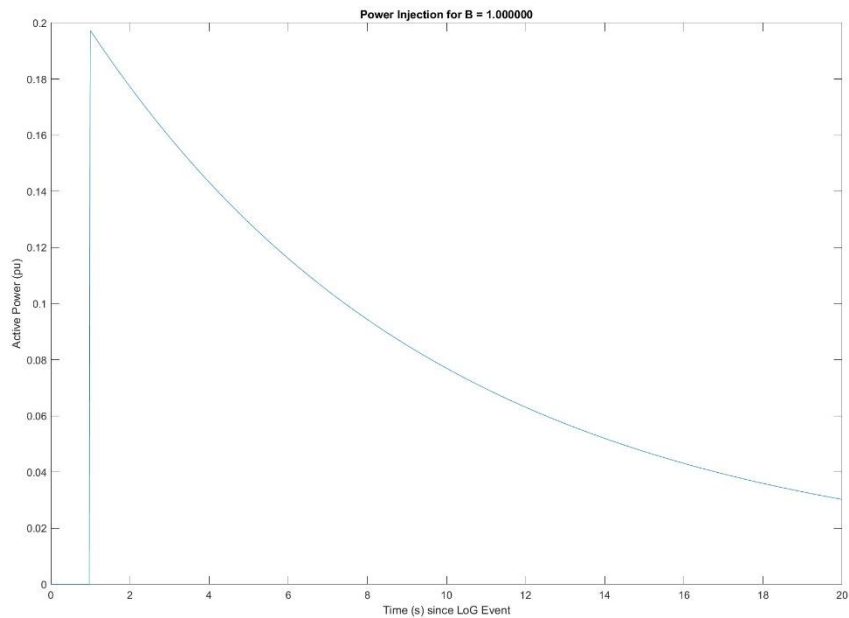


Figure 1: Ideal Injection

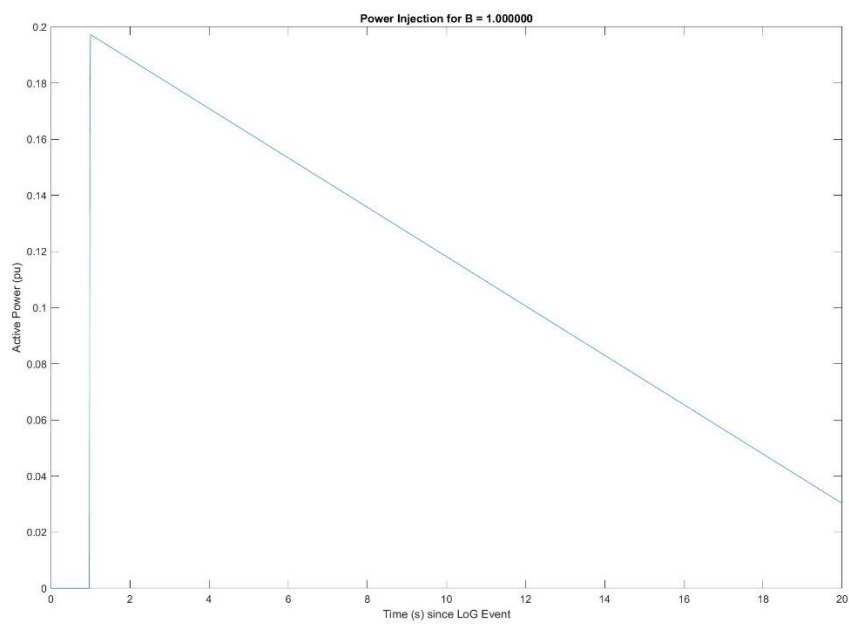
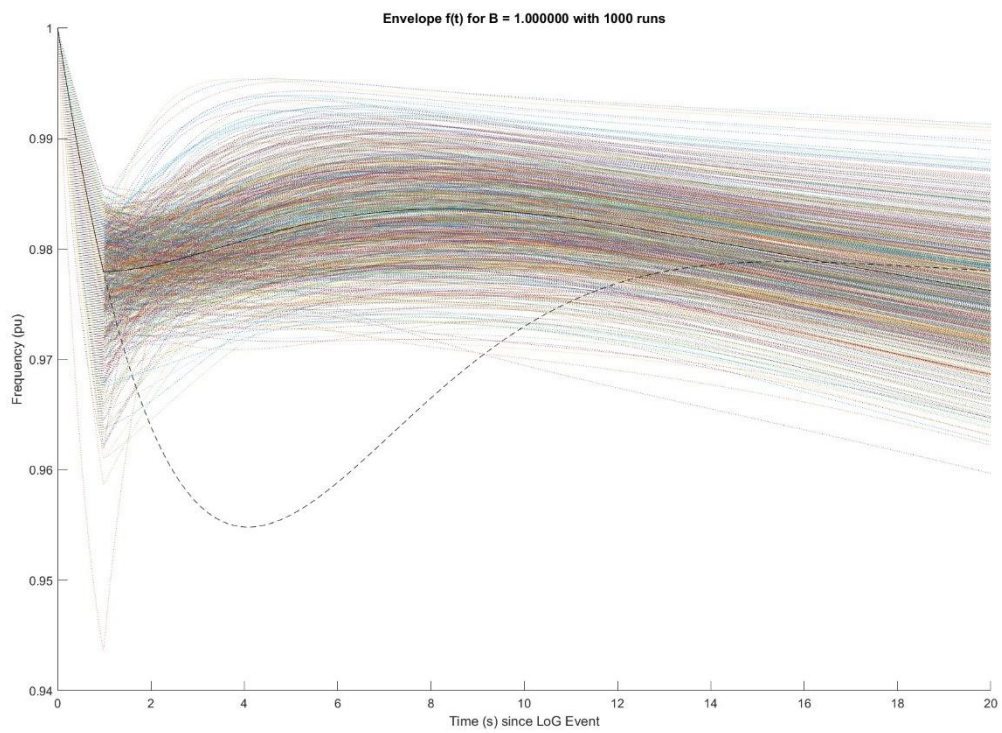


Figure 2: Simplified Injection

1000 Runs:



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:

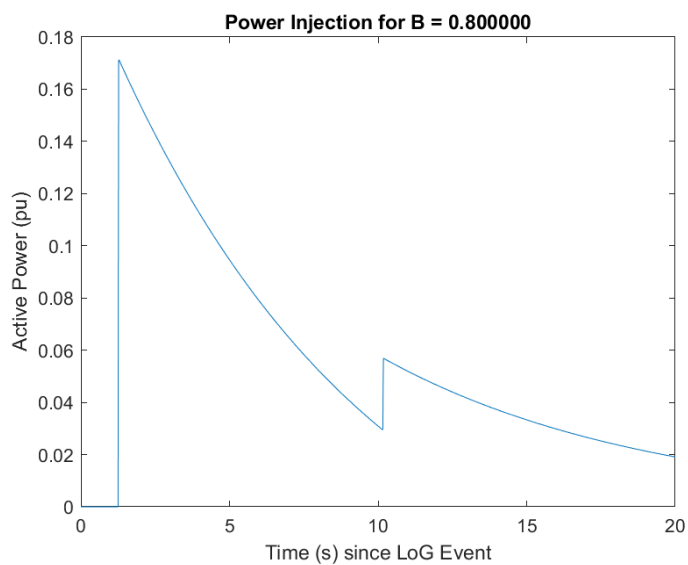


Figure 3: Ideal Injection

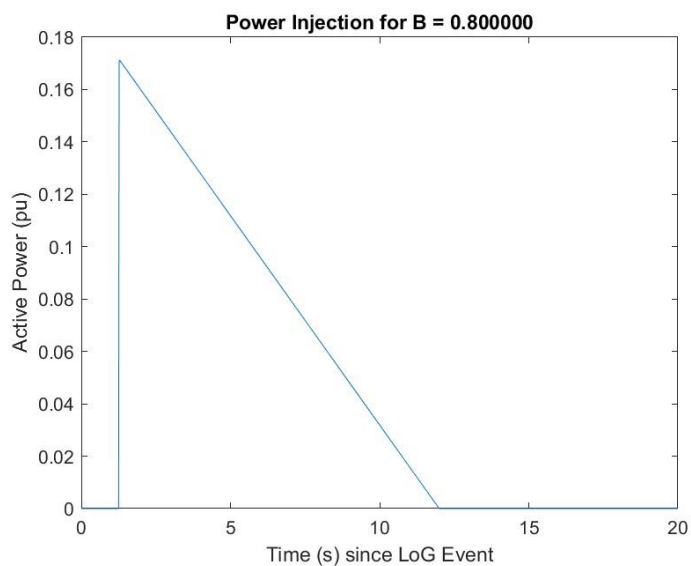


Figure 4: Halved Injection

1000 Runs:

