

## Quiz #7

### Design of Dynamic Systems

You are designing a light truck steering system. Customer surveys indicate that drivers prefer a consistent response of the steering system under a wide range of driving conditions (speeds, road surfaces, weather conditions, etc). The following data were collected to evaluate a baseline design:

Steering wheel angle (degrees)	Turning radius (feet)		
	Noise condition level 1	Noise condition level 2	Noise condition level 3
5	330	336	333
45	72	74	77
90	37	38	36

- 1) What problems might you run into if you performed a continuous-continuous dynamic signal to noise analysis using steering wheel angle as the signal and turning radius as the response? What would you choose as the signal factor and response of the system to make a continuous-continuous dynamic signal to noise analysis feasible? Sketch a graph (or a few graphs) to support your choice.

2) **Estimate** the slope of the least squares regression line ( $\beta$ ) between your chosen signal and response.

3) **Estimate** the error variance ( $\sigma_e^2$ ) for your chosen signal and response.

4) By parameter design, the signal to noise ratio of the system was increased by 12 dB while the error variance remained constant. What is your new estimate of  $\beta$ ?

5) Give an example of a scaling factor that can be used to return the value of  $\beta$  back to its original value prior to the parameter design.