Consider the set of tests that have missed pulses (blue data set), this is when the EGM period of less than 420 cycles. Tests with an EGM period of 420 cycles or greater have zero missed pulses. This observation occurs because the EGM period is much smaller than the polling period. Multiple stimulus pulses are sent between two polling points, so the processor never sees these rising edges, hence the missed pulses. The number of missed pulses decreases steadily as the EGM period increases because there are less pulses per sampling interval.

The set of tests with missed pulses has no correlation between the number of background tasks completed and the EGM period. Realistically, the total number of background tasks completed in this set should be all 0. The reason for this discrepancy is attributed to the characterization method. The background window is supposed to be determined from the detection of two consecutive stimulus (rising) edges. Since the EGM period is much smaller than the polling interval, the stimulus (rising) edges detected are not actually consecutive, hence greatly overestimating the background window.

Consider the tests without missed pulses (orange data set). Starting after an EGM period of 420 cycles, there is a general increasing trend with the total number of background tasks completed. The general trend of the number of background tasks increases more and more slowly as the EGM period and approaches a limit. This observation is expected because the EGM runs for a constant and predefined amount of time across all tests. Therefore, the number of background tasks for a test is limited by the constant EGM runtime, divided by the constant background task runtime.

This data set is further divided into segments by discontinuities. The discontinuities occur because the number of background tasks per cycle is an integer amount. When the EGM period increases above a certain value, the number of background tasks that can be completed within one EGM period increases by 1. Since there are thousands of stimulus pulses sent within the EGM runtime, the jump between the discontinuity is in the order of thousands (in number of background tasks).

The segments between discontinuities have a negative sloped curve. Consider the set of tests whose data is between two consecutive discontinuities. The negative slope can be derived as follows. The EGM runs for a constant and finite amount of time, let this time be T­­EGM\_runtime. As the EGM period, TEGM\_period, increases, the total number of stimulus pulses sent, Npulses decreases. The relationship between these variables is given by:

T­­EGM\_runtime = TEGM\_period x Npulses

The number of background tasks per EGM period (or per pulse), N­tasks/period, for this particular set of tests is constant. The total number of background tasks, Ntasks, is given by:

Ntasks = N­tasks/period x Npulses = N­tasks/period x (T­­EGM\_runtime / TEGM\_period)

The total number of background tasks, Ntasks, is inversely proportional to the EGM period, TEGM\_period, so from derivatives, the slope is negative.

There are a significant number of missed responses when the EGM period is less than 250 cycles, in the order of hundreds. This occurs because of the ISR’s overhead. Within the time interval to service the interrupt request, stimulus is still being sent, however it is impossible for the processor to respond to these stimuli because the ISR is already executing.

The set of tests with a period range of 250 to 596 cycles, have 2 or 1 (sometimes 0) missed pulses.

Starting after an EGM period of 250 cycles, there is a steadily increasing trend with the total number of background tasks completed. The general trend of the number of background tasks increases more and more slowly as the EGM period and approaches a limit. This observation is expected because the EGM runs for a constant and predefined amount of time across all tests. Therefore, the number of background tasks for a test is limited by (EGM runtime) / (runtime per background task).

The steady increase is expected because as the period increases, there are less stimulus pulses per test, which implies that less ISR’s are executed per test. With less time being spent servicing interrupt requests, the processor has more time to complete background tasks, hence the positive correlation between background tasks and EGM period.