**getCPTdata:**

* Get CPT data from file
* Delete all rows that contain zero qc and fs
* Return z, qc, fs, u2

**computeVs30:**

Calculate Vs30 from Vsz (Boore et al., 2011). This correlation does not consider the site class.

* Call **computeVsz** function to get z, mean Vsz, and StandDev\_Vsz
* Get coefficients [C0; C1; C2; σ] from table (z between 5 - 29 meters)
* Compute Vs30
* Compute standard deviation for Vs30 (first order second moment method):
* Note ‘ln(Vsz)’ is used in the derivative instead of ‘Vsz’ because the standard deviation is lognormal
* Return Vs30 and StandDev\_Vs30

**computeVsz:**

Calculate Vsz from randomly generated Vs profiles.

* Call **computeVs** to get z and an array of 50 randomly generated Vs profiles
* Calculte Vsz for each Vs profile
* If correlationFlag is 0, the expected Vsz is the average value
* If correlationFlag is 1, Vsz then has a lognormal distribution, the expected Vsz is
* Return z, mean\_Vsz, and StandDev\_Vsz

**main:**

* Inputs:
* **filename**
* **correlationNames** (‘McGann’, ‘Andrus’, ‘Hegazy’, ‘Robertson’)
* **correlationFlag** (0 = no correlation, 1 = perfect correlation)
* Call **getCPTdata** function to get z (m), qc (MPa), fs (MPa), and u2 (MPa).
* Call **computeVs30** function to get Vs30, StandDev\_Vs30 for each correlation

**computeVs:**

* Call **getCPTparam** to get basic CPT parameters such as Ic, Qtn, etc.
* From **VsCorrelations** calculate Vs based on chosen correlation
* Make the Vs in the first meter constant (set limits for shallow depth Vs, can’t be 0 or too large)
* If correlationFlag is 0:
* Randomly generate 50 samples for each Vs
* If correlationFlag is 1:
* Randomly generate 50 samples for the first row of Vs
* Calculate residual StandDev and lognormal StandDev
* Apply the same StandDev to the rest Vs, so it has a perfect correlation
* (optional) plot predicted Vs against measured Vs
* Return z and random selected Vs

**getCPTparam:**

* Assume area ratio = 0.8, soil weight = 1.9 (MN/m3), ground water table = 1 (m)
* Ic is calculated based on the non-normalised CPT soil behaviour type (Robertson, 2010).

You can also use iteration method to find normalised Ic, n and Qtn, results are pretty similar.

* qc1n and qt1n are assumed to be the same as Qtn, it doesn’t make a significant difference
* Return qt, Ic, Qtn, qc1n, qt1n, and effective stress

**VsCorrelations:**

* **Vs\_McGann (qc, fs in kPa)**

StandDev = 0.162 (z <= 5)

StandDev = 0.216 – 0.0108z (5 < z < 10)

StandDev = 0.108 (z > 10)

* **Vs\_Andrus (qc, fs in kPa)**

Holocene-Age Soils, where ASF = 1

residual standard deviation: suggests that 68% of the data fall within 24m/s.

* **Vs\_Robertson (MPa)**

Since the standard deviation is not available in the paper, assume to be 0.2

* **Vs\_Hegazy (MPa)**

Since the standard deviation is not available in the paper, assume to be 0.2