Homework Set #9

The pressure acting on the windows of a high-rise building is $Y = CV^2$, where V is wind speed in km/hr, and C is a local effect factor, the units of which are such that Y is in kg/cm^2.

The local effect factor and the 10-year peak wind speed at the site of the building have the following mean values and standard deviations:

$$m_C = 0.0001, \quad \sigma_C = 0.0001$$
$$m_V = 100, \quad \sigma_V = 20$$

C and V are uncorrelated.

The strength of the window is $Y^* = 5$ kg/cm^2.

(a) Sketch the failure boundary in (C, V) space for $0.0001 < C < 0.0005$ and $100 < V < 200$.

(b) Make the corresponding plot in the space of the normalized variables C' and V':

$$C' = \frac{C - m_C}{\sigma_C} \quad \text{and} \quad V' = \frac{V - m_V}{\sigma_V}$$

(c) Calculate the second moment reliability index β for a 10-year exposure using the iterative procedure given in class. Operate in the space of the normalized variables C' and V'.

(d) On the sketch you made, indicate the iterations and show convergence to the β point.