Piezo-electric Vibration Energy Harvester

(1) calc the acceleration of the beam

$$a_z = \frac{1}{\beta}\frac{1}{m}(-kz - cv) + Acos(\Omega t/\beta)$$

(2) Calculate the vertical velocity and displacement

$$\Delta v = a\Delta t$$
$$v = v + \Delta v$$
$$\Delta z = v\Delta t$$
$$z = z + \Delta z$$

These lines may appear a little strange. The first two will be coded as **velyZ += accelZ*dT;** and the last two will be coded as **dispZ += velyZ*dT;**

(3) Calculate the voltage

voltage = (3.25*1000/8.0)*dispZ;

and the root mean square voltage

rmsVoltage = voltage/sqrt(2);

(4) and the rms power

rmsPower = 1000000.0*rmsVoltage2/loadResistance;**

Variables

Math	Code	Meaning	ICs
Δt	deltaT		0.01
t	time		0
z	dispZ	vertical displacement from equilibrium	
v	velyZ	vertical velocity	
a	accelZ	vertical acceleration	
	voltage	calculated internally from dispZ	
	rmsPower	calculated internally from voltage	

Parameters

Math	Code	Default	Meaning
m	mmass	Note 1	effective mass
k	k	Note 1	effective stiffness
c	damp	0.005	damping
	loadResistance	100000	load resistor
β	beta	50	time scaling for slow-down
	choice	PEH_S	Type of beam

Note 1. These are calculated internally from the choice of beam type. Look in the function **initializeVariables()**. The values here have been taken from the Dhakar et al.paper on my web-pages. The type of beam is indicated there.

Sinusoidal drive equation parameters

A	driveAmp		30
Ω	2*pi*driveFrequ	**driveFrequ**	36 (Hertz)

If you wish to HUD the maximum voltage and power (root mean square) then you could add this code.

```
if(rmsVoltage > maxRmsVoltage) maxRmsVoltage = rmsVoltage;
if(rmsPower > maxRmsPower) maxRmsPower = rmsPower;
if(dispZ < 0) {
  maxRmsVoltage=0;
  maxRmsPower = 0;
}
```