The frequency averaged energy density is

$$< W_{energy} >= \frac{1}{\Delta f}\int_{f_l}^{f_u} W_{energy}(f)df \qquad (7s)$$

Numerically, the frequency averaged energy density eq. (7s) can be calculated as a sum of the energy density of N frequencies

$$< W_{energy} > \approx \frac{1}{\Delta f}\sum_{n-1}^{N} W_{energy}\delta f \qquad (8s)$$

where N can be evaluated as

$$N = \frac{f_u - f_l}{\delta f} + 1 \qquad (9s)$$

where δf is the frequency increment, which should be less than one-half the average separation of resonant frequency δf_{res}. The average frequency spacing between modal resonances in a two-dimensional systems is

$$\delta f \le \frac{1}{2}\delta f_{res} = \frac{c_g^2}{8\pi fab} \qquad (10s)$$

7 式用 8 式代替　7 式即为在某个频率范围[fl，fu]内对 W 进行积分后除以该区段长度进行频率平均。由于该积分运算较为复杂　故改为用 8 式的级数累加求得按照出处的原文

> S. Wang, R.J. Bernhard / Journal of Sound and Vibration 319 (2009) 426–444　435
>
> The frequency-averaged energy density was calculated using a sum of the energy density at N frequencies
>
> $$\bar{e} \approx \frac{1}{\Delta f}\sum_{n=1}^{N} e\delta f, \qquad (58)$$
>
> where N is
>
> $$N = \frac{f_u - f_l}{\delta f} + 1, \qquad (59)$$
>
> where δf is the frequency increment, which could be chosen to be less than one-half the average separation of resonant frequencies $\overline{\delta f}$ [5]. The average frequency spacing between resonances in a 2-D system is [13]
>
> $$\overline{\delta f}^{2D} = \frac{1}{2\pi n(f)} = \frac{c_g^2}{4\pi fab}, \qquad (60)$$
>
> where $n(f)$ is the modal density.

有两种理解：

理解一：

每一个累加（从 1 到 N）中的 f 都是中心频率 则 8 式（出处中式 58 将变为（$N*W_{energy}\delta f$）/Δf）

理解二：
在频率范围[fl，fu]内，f 被均分为 N 份，则区段内第 i 个累加对应的频率 f 为 fl+(fu-fi/N)*(i-1) 将这个带入式 10 并进入最终的级数累加式 8

目前的编程

```
f=2000;
fu=2800;
fl=1400;
cg=2*(((2*pi*f)^2*(D/(rho*h)))^0.25)
deltaf=cg^2/(8*pi*f*a*b);
N=floor(((fu-fl)/deltaf)+1)
Wfreavg=(symsum(W,'f',1,N))/(fu-fl)
```

实际上是错误的 这等于 f的赋值为1到N 期望的f赋值为 情况1的 都为2000 或者情况2的累加
情况2的累加应该如何编程实现？

附：

The forced response under modal solution of a point force excited simply supported plate can be evaluated as

$$w(x,y)=\sum_{m=1}^{\infty}\sum_{n=1}^{\infty}\frac{4F}{ab}\frac{\sin\frac{m\pi u}{a}\sin\frac{n\pi v}{b}}{(1+j\eta)\pi^4 D[(\frac{m}{a})^2+(\frac{n}{b})^2]-\rho h\omega^2}\sin\frac{m\pi x}{a}\sin\frac{n\pi y}{b} \quad (5s)$$

Therefore, the energy density at any point of the plate is given by

$$W_{energy}=\frac{D}{4}\left\{\left|\frac{\partial^2 w}{\partial x^2}\right|^2+\left|\frac{\partial^2 w}{\partial y^2}\right|^2+2\mu\,\mathrm{Re}[\frac{\partial^2 w}{\partial x^2}(\frac{\partial^2 w}{\partial y^2})^*]+2(1-\mu)\left|\frac{\partial^2 w}{\partial x\partial y}\right|^2+\frac{\rho\omega^2}{D}|w|^2\right\}$$

(6s)

where the superscript * is the complex conjugate.

The frequency averaged energy density is

$$<W_{energy}>=\frac{1}{\Delta f}\int_{f_l}^{f_u}W_{energy}(f)df \qquad (7s)$$

Numerically, the frequency averaged energy density eq. (7s) can be calculated as a sum of the energy density of N frequencies

$$< W_{energy} > \approx \frac{1}{\Delta f} \sum_{n-1}^{N} W_{energy} \delta f \qquad (8s)$$

where N can be evaluated as

$$N = \frac{f_u - f_l}{\delta f} + 1 \qquad (9s)$$

where δf is the frequency increment, which should be less than one-half the average separation of resonant frequency δf_{res}. The average frequency spacing between modal resonances in a two-dimensional systems is

$$\delta f \le \frac{1}{2} \delta f_{res} = \frac{c_g^2}{8\pi fab} \qquad (10s)$$