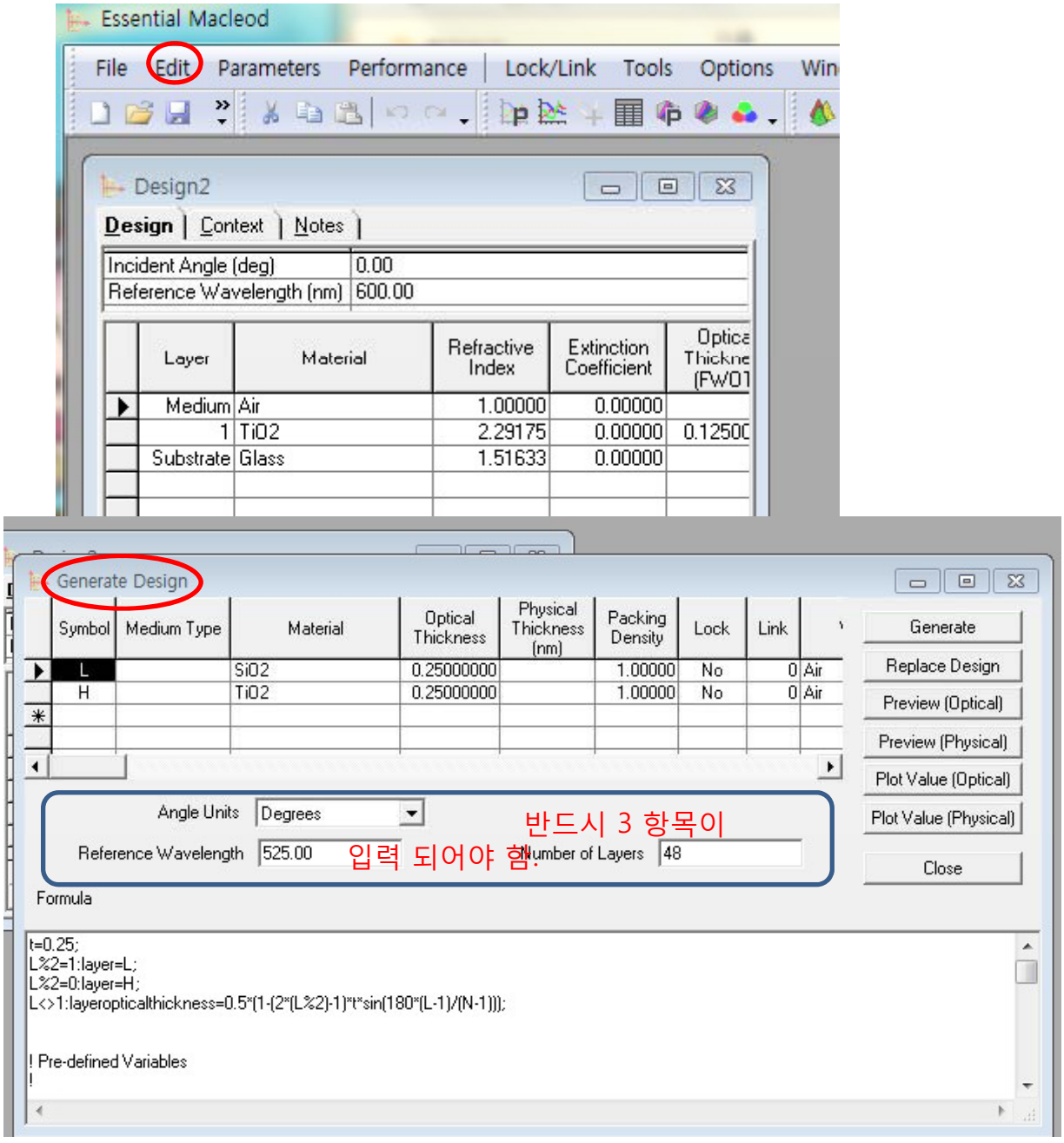
수식 (조건)을 이용한 디자인 파일 만들기

수식(조건)을 이용하여 Design File을 쉽게 만들수 있는 기능.

File > New > Design, 새로운 디자인 파일을 연다.

"Edit > Generate Design "



Symbol (수식) 정리

L : 현재 층, N : 총 층수, "!" : Comment(문구) 표시로 맨 앞에 위치.
":" 조건, "=" 변수, ";" 문장 끝 의미.

L : 현재 층, L%2=1 : 현 층을 2로 나누어 나머지가 1 즉, 홀수 층
L%2=0 : 현 층을 2로 나누어 나머지가 0 즉, 짝수 층을 의미 합니다.
그러므로
L%2=1:layer=L;
L%2=0:layer=H;
L<>1:layeropticalthickness=0.5;

즉, 필요한 설계 조건을 수식으로 입력합니다.

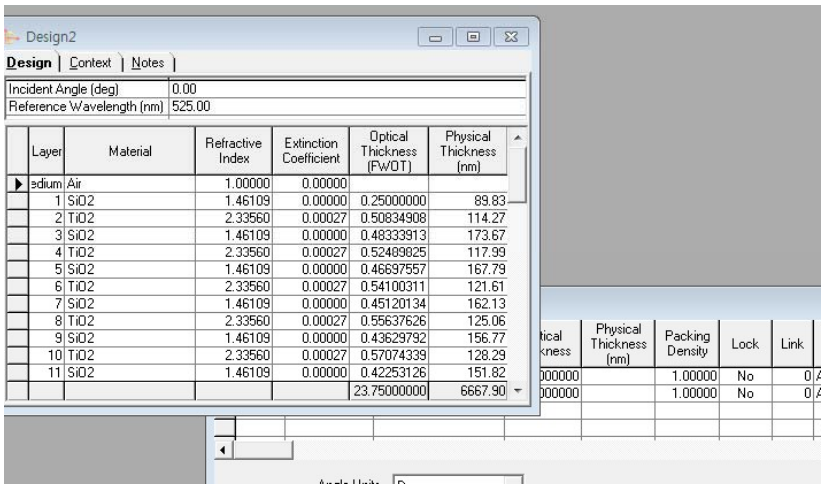
예를 들면,
L%2=1:Layer=H; 현 층을 2로 나누어 1이 되는 층 (홀수 층) 은 H 이다.
Value : limiting value (제한치), Value=0.5;
high-index layers로
LayerOpticalThickness=Value*(L-1)/(N-1);
low-index layers로
LayerOpticalThickness=Value*(N-L-1)/(N-1); 가 되므로

홀수.짝수 층 방식으로 수식을 주면
L%2=1:LayerOpticalThickness=Value*(L-1)/(N-1);
L%2=0:LayerOpticalThickness=Value*(N-L-1)/(N-1);
이식을 합성하면 아래와 같이 됩니다.
LayerOpticalThickness=Value*((L%2)*(L-1)+((L+1)%2)*(N-L-1))/(N-1);

그러므로 전체 수식은
L%2=1:Layer=H;
L%2=0:Layer=L;
Value=0.5;
LayerOpticalThickness=Value*((L%2)*(L-1)+((L+1)%2)*(N-L-1))/(N-1);

"Preview (Optical)"로 확인 후
"Replace Design" 하면
수식에 따른 Design File로
변경되어 보입니다.

※ 기타 명령어는 다음 장
참고 하세요...



When a design is being generated, the statements in the Formula are executed in order from top to bottom. If a statement has a *Condition*, then the *Assignment* is only executed if the value of the *Expression* in the *Condition* is not zero. If the statement does not have a *Condition*, then the *Assignment* is always executed. The *Assignment* calculates the value of the *Expression* and stores the value in the *Assignment Variable*. *Variables* are automatically created if they do not already exist. There are several special variables:

L	The current layer number. This variable cannot be modified. The first layer is numbered 1 and the last layer has the value **N**.
N	The number of layers as entered in the Number of Layers box. This variable cannot be modified.
OpticalThickness	The total optical thickness of the design excluding the current layer. This variable cannot be modified.
PhysicalThickness	The total optical thickness of the design excluding the current layer. This variable cannot be modified.
LayerOpticalThickness	The optical thickness of the current layer.
LayerPhysicalThickness	The physical thickness of the current layer.
LayerLocked	The lock state of the current layer. A value of 0 means the layer is not locked. A value of –1 means the layer is locked.
LayerLink	The link number of the current layer.
LayerPackingDensity	The Packing Density of the current layer.
LayerVoidDensity	The Void Density of the current layer.
LayerN	The refractive index of the current layer. This variable cannot be modified.
LayerK	The extinction coefficient of the current layer. This variable cannot be modified.
MaterialN	The refractive index of the current layer material. This variable cannot be modified.
MaterialK	The extinction coefficient of the current layer material. This variable cannot be modified.
VoidMaterialN	The refractive index of the current layer void material. This variable cannot be modified.
VoidMaterialK	The extinction coefficient of the current layer void material. This variable cannot be modified.
Layer	This is used to initialize the parameters of the layer. It should be used before any layer parameters are modified.

Thickness	Cumulative Thickness to center of current layer: (**L**-1) * **LayerThickness** + **LayerThickness** / 2. This variable cannot be modified.
ReferenceWavelength	Reference Wavelength as entered in the Reference Wavelength box. This variable cannot be modified.
PackingDensity	The Packing Density of the current layer. After all the statements have been executed, the current layer's packing density will be the value of this variable. This variable can be modified.
InhomogeneityFactor	The Inhomogeneity Factor of the current layer. After all the statements have been executed, the current inhomogeneity factor will be the value of this variable. This variable can be modified.
MinimumPhysicalThickness	The Minimum Physical Thickness for the current layer. After all the statements have been executed, the current layer's minimum physical thickness will be the value of this variable. This variable can be modified.
MaximumPhysicalThickness	The Maximum Physical Thickness for the current layer. After all the statements have been executed, the current layer's maximum physical thickness will be the value of this variable. This variable can be modified.
MinimumOpticalThickness	The Minimum Optical Thickness for the current layer. After all the statements have been executed, the current layer's minimum optical thickness will be the value of this variable. This variable can be modified.
MaximumOpticalThickness	The Maximum Optical Thickness for the current layer. After all the statements have been executed, the current layer's maximum optical thickness will be the value of this variable. This variable can be modified.

The following operators are supported in *Expressions*:

()	sub-expressions
^	power
*, /	multiplication, division
%	modulus (remainder)
\	integer divide
+, -	addition, subtraction
>, >=, <, <=, <>	logical comparison
&, |	logical "and", logical "or"

An operator that is listed on a line above another operator has a higher precedence. The following functions are also supported (they are not case sensitive): Abs, Sin, Cos,

Tan, ACos, ASin, Atn, Log, Log10, Exp, Sqr, Int, Frac, Ceil, and Floor. Trigonometric functions accept and return angles expressed in radians or degrees, depending on the setting of **Angle Units**.

For each layer generated, the formula must perform a layer initialization as follows:

Layer = <symbol>

Where symbol is a defined symbol in the table shown at the top of the form.

For example, the formula:

Odd = ((L % 2) =1);
Even = ((L % 2) = 0);
Odd: Layer = L;
Even: Layer = H;

will generate an design of alternating H and L layers with no modifications to the layer parameters.

Click on **Preview (Optical)** to generate an index profile plot of the design as a function of optical thickness. Click on **Preview (Physical)** to generate an index profile plot of the design as a function of physical thickness. These commands allow you to verify that the correct structure has been generated. The design can be made available in two ways: Clicking on **Generate** will put the layers of the design onto the clipboard. These layers can be pasted into any design in the normal way. Clicking on **Replace Design** will cause the current design's layers to be completely replaced with the layers of the formula. Selecting a variable name in the Formula and then clicking on **Plot Value (Optical)** or **Plot Value (Physical)** will display a plot showing the value of the variable as a function of optical thickness or physical thickness respectively. This is useful for making sure that the variable's value is set correctly during design generation.

This example shows the implementation of an amplitude thickness modulated design presented in Chapter 3 of "Thin Film Design Modulated Thickness and Other Stopband Design Methods by Bruce E. Perilloux ISBN: 0-8194-4525-8 Pub SPIE Press 2002. The function for modulating the thickness is given as:

$$T(L) = T_{AVG}[1 + k' \sin(2\pi f_1 L) \cos(2\pi f L)]$$

In the Generate Design tool, this function appears as:

```
Pi = 3.1415926;
k = 0.5;
f = 0.358;
f1 = 0.02;
(L % 2) = 1: Layer = H;
(L % 2) = 0: Layer = L;
LayerOpticalThickness = LayerOpticalThickness * (1 + k* sin(2 * Pi * f1 * L) * cos(2 * Pi * f* L ));
```

The first four lines define constants for the formula. The next two lines specify that the design is made from alternating layers of H and L material. H material is used on the odd numbered layers and L material is used on the even numbered layers. The final line performs the modulation function. The optical thickness of the layer is modified by the modulation function.