The following table is extracted from the excel file I sent to before I will be referring to it:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **\*This only applies for WVC** | |  |  |
|  | **# of entry of WVC** | **wvc values** | **Information found in mkwave.pro** |  |
|  | 1 | 2.5 | file structure version number |  |
|  | 2 | 3200 | number of columns in spectrum |  |
|  | 3 | 59 | number of orders in spectrum |  |
|  | 4 | 65 | base order in spectrum |  |
|  | 5 | 0 | filler in reserved space |  |
|  | 6 | 0 | filler in reserved space |  |
|  | 7 | 0 | filler in reserved space |  |
|  | 8 | 6 | number of cross-terms |  |
|  | 9 | 6 | degree of column fit poly |  |
|  | 10 | 6 | degree of order fit poly |  |
|  | 11 | 563348.7795 | Constant |  |
|  | 12 | 2123.450977 | (Coef. for : x ) |  |
|  | 1 | -24.63351259 | (Coef. for : x^2 ) |  |
|  | 14 | 1.551684556 | (Coef. for : x^3) |  |
|  | 15 | -1.972312631 | (Coef. for : x^4 ) |  |
|  | 16 | 0.490951498 | (Coef. for : x^5 ) |  |
|  | 17 | -0.044106508 | (Coef. for : x^6 ) |  |
|  | 18 | -2018.425523 | (Coef. for : y) |  |
|  | 19 | 5721.70369 | (Coef. for : y^2) |  |
|  | 20 | -8348.770993 | (Coef. for : y^3) |  |
|  | 21 | 6660.181002 | (Coef. for : y^4) |  |
|  | 22 | -2750.838833 | (Coef. for : y^5) |  |
|  | 23 | 466.4204963 | (Coef. for : y^6) |  |
|  | 24 | -87.65957411 | (Coef. for :xy) |  |
|  | 25 | 0.989158763 | (Coef. for :x^2y) |  |
|  | 26 | 153.1039969 | (Coef. for :xy^2) |  |
|  | 27 | 0.0034268 | (Coef. for :x^2y^2) |  |
|  | 28 | -0.335024024 | (Coef. for :x^3y) |  |
|  | 29 | -68.84832945 | (Coef. for :xy^3) |  |

The main part of “mkwave.pro” is structure as follows:

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For (every order) : 🡨 (A)

For (every “x” coefficient) : 🡨 (B)

For (every “y” coefficient) : 🡨 (C)

Case (This applies for cross terms “xy”) 🡨 (D)

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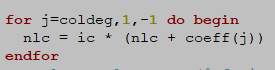
* Note that (B), (C), (D) are nested inside the “bigger” for loop (A)
* Note that echelle ThAr spectrum is not passed nor used in this procedure. All the variables used in here are extracted from “achi\*thid.sav”. Specifically, from “thid.wvc”
* “thid.wvc” specifies the #of pixel and the # of orders collected by the spectrometer. (Refer to the excel file or our table above for more information)

Bellow find more information about (A), (B), (C) and (D)

1. **In IDL is written as:**

This FOR loop iterates over every order. E.g: starts at Order = 0 and ends at Order = #of orders

Since (A) is the “bigger” loop I am going to take one specific order to use it with (B), (C) and (D). We take Order = 1 = O1

1. **In IDL is written as**:

* This For loop iterates over every “x” coefficients. Therefore, it will loop a total of 6 times, once for every “x” coefficient.
* The variable “coldeg” is the value obtained from the 9th entry of Table 1 (degree of column fit poly) .
* The variable “coeff “has the values of all coefficients (values of entries 11th to 29th in our table). Thus at each iteration “coeff(j)” takes the following values: entries 17th to 12th , respectively. Note that the For loop starts at the coefficient of X^6 and ends at the coefficient of X.
* Initially the vector (# of pixels), “nlc”, is filled with 0.. E.g: 0,0,0,0………0 . Note the # of zeros = # of pixels
* “ic” is a vector (# of pixels) : E.g : 0.000,0.001,0.002..........(#of pixels )/1000. I believe that every pixel was divided by 1000 so it scales down the Coefficients by the moment they get added inside the for loop.
* Note: the variables “ic” and “nlc” are 1-d array (vector) with the length = #of pixels BUT coeff(j) is a double which applies to all elements in “ic” and “nlc”.
* Since “nlc” and “ic” are vectors then every element of this vectors is operated simultaneously. I try to represent this in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **# Of Iteration** | **For Pixel 0= 0** | **For pixel 1=1** | **………** | **For Pixel n= #of Pixels** |
| **1** | nlc= 0 \*(0+ coef(x^6) )  nlc(1) = 0 |  | …. | …. |
| **2** | nlc = 0 \*(0+ coef(x^5))  nlc(2)= 0 |  | …. | …. |
| **3** | nlc(3)=0 \*(0+ coef(x^4)) |  | …. | …. |
| **4** | nlc(4)=0 | …………………. | ….. | ….. |
| **5** | nlc(5)=0 | …………………. | …. | ….. |
| **6** | nlc(6)=0 |  | ….. | ….. |

So basically, the result of this for loop is “nlc” which is a vector (1-d array) of length= # of pixels where wavelength has been calculated only for the coefficients of “x” (pixels). The result of “nlc” has been highlighted in gray above.

1. **In IDL is written as:**



* This For loop iterates over every “y” coefficient. Therefore, it will loop a total of 6 times, once for every “y” coefficient.
* The use of the variables “coldeg” and “orddeg” set up the FOR loop to iterate over entries 23rd to 18th of our WVC table.
* The variable “nlo” is initially a vector (#of Pixels) filled with zeros. E.g: 0, 0, 0, …..0

Regarding about question asked yesterday (?):

* Note that the variable “order” is a double which value equals 1 (since we said that we are taking order1 = 1 as an example for our “bigger” for loop). This is where my confusion lies (this is regarding the question I asked yesterday but did not explain properly). Basically the “Y” is represented by the variable “order” but the order has a constant value through out this FOR loop, unlike “X” which value is the pixel# and it goes from 0 to #of pixels. I do not see the reason why they are taking the order number as the “Y” component since it behaves like a constant.
* The procedure of this for loop can be simplify because the vector “nlo” is initially filled with zeros and the other 2 variables are doubles.
* For E.g (for the 1st entry of “nlo” ):

|  |  |
| --- | --- |
| # of iteration |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 | ……. |
| 6 |  |

The expression highlighted in gray will be result for EVERY entry in “nlo”

1. **In IDL this is written as:**

* This is not a for loop but rather a specific case if 6 cross terms are being found in the WVC which is our case. It uses the coefficients of our table from the 29th to the 24th .
* the “order” is the same variable used in (C) and represents the “Y” component
* The variable “ic” is a vector (#of pixels) which represents the “X” component. E.g: 0/1000, 1/1000,2/1000,……(#of pixels)/1000, is the same as used in (B)

Finally, these three results are added together (+ the constant term) as shown in here:



And then, the same procedure (B), (C) and (D) take place for orders : 2,3,4…. (#of orders)

The variable “w” is the output of this procedure. Where every pixel has been transformed to a wavelength.