Arbitrary, Non-Uniform Shaped Microphone Array.

Without loss of generality:

The exponent Taylor approximation is

Therefore, when determining the order of the array (N) we get:

If we expand to its basic components we shall get:

We define the filter vector as:

And we denote.

So, we have the general beam pattern:

When one wants to create a specific directed beam pattern, he should first find the coefficients of the basic beam pattern components.  
Among the many optional methods, is the one proposed here:

TODO: prove convergence

The proposed method is

Is the steering angle

We set the conditions for the optimization:

And one can compare the two series and find that:

As one can recall, we “expanded” the so now we have to find a way to undo it because we want each microphone to have only one filter.

Unfortunately, in this result, resides the basic problem of arbitrary geometry arrays.  
Theis a function of. Hence, the needs to be also dependent in which is obviously not possible.

Therefore, the next stage will be a numerical approach to try and decouple the two variables.

We will “sample” the possible directions with a predetermined ( number of samples   
and now one can collect the K equations that correlates to those sampled directions.

And now we want to find a solution for:

And with the Least Mean Squares solution we get the result (general solution even for over-determined problem – pseudo inverse):

Arbitrary geometry diffuse noise correlation matrix

Let’s assume the array is represented by and the noise sources are uniformly distributed around the reference point with.