3.4. Universal Bragg reflector

The spectral response of a standard DBR is the key to that of the whole system, whatever the precise values of the "couplonic" parameters. Moreover, any actual lossless DBR can be reduced to one instance of a "universal" lossless Bragg reflector, as schematically depicted in Figure 4. As a matter of fact, only two parameters (κL, δL) govern its behaviour.

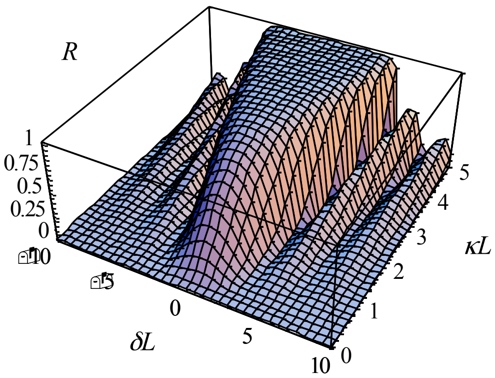

Figure 4: Normalised reflectance $R = |M_{21}/M_{11}|^2$ of a "universal" DBR.

Each spectrum of Figure 3 can be recovered by following a specific path over the universal relief of Figure 4. By an obvious topographic analogy [9], we can speak of "couplonic alpinism".

4. Conclusions

We have established analytically, in terms of reduced dimensionless parameters, the spectral responses of a cyclic ternary system made of symmetrically coupled periodic waveguides. In the supermode basis, the method stems from a rigorous mathematical identification between the continuous and discrete configurations.

As paradoxical as that may seem, any *discrete* ternary systems with the right symmetries can be described, without any approximation, by a *continuous* evolution operator: Initially looked upon as resulting from a mere approximation, couplonic parameters ($\kappa\Lambda$, $\delta\Lambda$, $\chi\Lambda$, $\xi\Lambda$) prove much more rigorous than expected. The usual distinction between *localised* and *distributed* interactions is therefore blurred.

Taking losses into account would not cause any special difficulty: it would be enough to add two new reduced parameters, corresponding respectively to average losses and to loss-modulation (loss coupling). Optical amplification would appear just as straightforward, the structure becoming a cyclic array of coupled Distributed Feedback (DFB) emitters [10].

The so-called "couplonic" approach is an elegant as well as powerful theoretical tool, not only for studying spectrally selective splitters, but also for the analysis or synthesis of discrete electromagnetic crystals of finite size [5]. Moreover, it comes well within the framework of current research on *discrete photonics* based on coupled waveguides [11-12].

5. Acknowledgements

The author would like to thank Nadia Belabas and her coworkers from Laboratoire de Photonique et de Nanostructures (LPN, CNRS UPR 20), Marcoussis, France, for inspiring discussions.

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