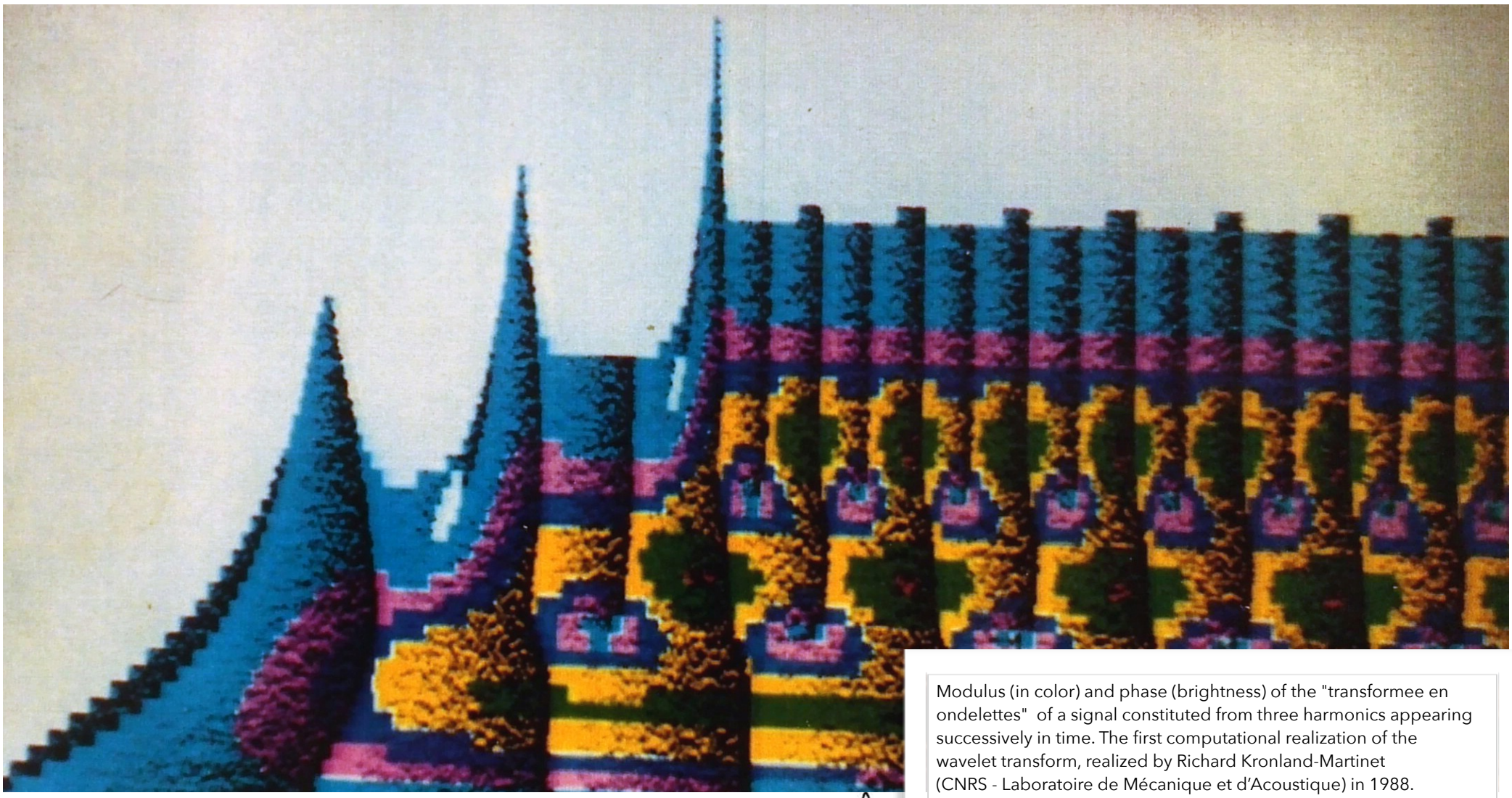

Modulus (in color) and phase (brightness) of the "transformee en ondelettes" of a signal constituted from three harmonics appearing successively in time. The first computational realization of the wavelet transform, realized by Richard Kronland-Martinet (CNRS - Laboratoire de Mécanique et d'Acoustique) in 1988.

30 YEARS OF WAVELETS: IMPACT & FUTURE

January 23/24, 2015 at CIRM

Marseille-Luminy www.chairejeanmorlet.com

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The idea of wavelets was promoted by Jean Morlet in the early 80s and developed into an important mathematical theory and a crucial tool for many areas in analysis afterwards. In the presence of two of the senior contributors, the French mathematicians Alex Grossmann and Yves Meyer an impressive group of "wavelet pioneers" will present their views on the history, the impact and the future of the field. Most of the presentations will be recorded and made online available through CIRM afterwards.

The main idea of wavelets is to represent a function, signal or even tempered distributions by building block of "constant shape", i.e. by so-called "wavelets" (in French: "ondelettes") or "atoms" which are obtained from a "mother wavelet" (a function with integral zero, therefore looking like a little wave) by translation and dilation. Soon the idea of a multi-resolution analysis came up, which allows to decompose e.g. images into coarse and fine levels, which has important applications for image compression and transmission. At the same time many operators do have a "sparse matrix representation" with respect to such wavelet frames.

Since the early days of wavelet theory many important French contributions have contributed to the vivid development of the field. The Mathematical Genealogy Project currently lists 500 PhD theses in the last 25 years related to the topic of wavelets. This development concerned both the mathematical foundations as well as the applications. For many years thousands of subscribers have been following the Wavelet Digest.

The discussions about Wavelets had also some ''side-effects'', which are in the long run maybe more important than the concrete systems. One modern branch of analysis is ``compressed sensing'', which in turn is based on the idea of sparsity. Whenever one wants to represent a signals (typically elements of a high-dimensional space, e.g. a pixel images) with a small number of coefficients in one of those bases. Nowadays a great variety of such expansion is available (wavelets, Gabor expansions, shearlets, curvelets, etc., to name just a few) and various strategies to explore this situation, and use if for the treatment of high-dimensional data sets, have been developed.

The meeting brings together a group of mathematicians who have contributed significantly to the field during the last 30 years, providing a testimonial of the early developments, reflecting on the impact that wavelet theory had on the various branches of analysis respectively in the different application areas, and finally trying to indicate directions which will play a role in the future. Last but not least the wavelet community has established a new way of cooperation between mathematicians and the applied sciences which by itself will continue to be fruitful in the future.

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