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Just as an image can be described as a mixture of colors (light frequencies in the visible part of the electromagnetic spectrum), a sound object can be described as a blend of elementary acoustic vibrations. As the pioneering acoustician D. C. Miller wrote a century ago:

> Will not the creative musician be a more powerful master if he is also informed in regard to the pure science of the methods and materials of his art? Will he not be able to mix tone colors with greater skill if he understands the nature of the ingredients and the effects which they produce?

One way of dissecting sound is to consider the contribution of various components, each corresponding to a certain rate of variation in air pressure. Gauging the balance among these components is *spectrum analysis*.

A working definition of spectrum is “a measure of the distribution of signal energy as a function of frequency.” Amazingly, no more general and precise definition of spectrum exists. This is because myriad analysis techniques measure properties that they each call “spectrum” with more-or-less diverging results. The practice of spectrum analysis is not an exact science. The results are typically an approximation of the actual spectrum, so it is perhaps more precisely called *spectrum estimation*.

We often seek to measure the spectrum as it evolves in time. Thus *time-frequency analysis* describes a spectrum that is changing in time, and the data the analysis produces is called a *time-frequency representation*.

Time-frequency spectrum plots reveal the microstructure of vocal, instrumental, and synthetic sounds. Thus they are essential tools for the acoustician and psychoacoustician. Musicologists are increasingly turning to sonograms in order to study music performance and the structure of electronic music. This extends to automatic transcription of music – from sound to score – either in common music notation or a graphic form. A great deal of effort has been invested in the past two decades into the creation of sound databases in which sounds can be accessed according to their acoustic properties (called *audio descriptors*) and compared with other sounds, enabling *music information retrieval* and *automatic music recommendation systems*.

But musicians want not only to analyze sounds; they want to modify the analysis data and resynthesize variants of the original sounds.

For this reason, the *phase vocoder* (PV) is one of the most successful spectrum analysis tools in the field of electronic and computer music, based on its many implementations and widespread use. Originally conceived for speech coding, the PV has had its greatest impact in the realm of music, following James A. Moorers landmark 1978 paper, which brought the PV to the attention of the computer music community. One of the most powerful transformations made possible by the PV is high-quality pitch-time changing, that is, changing the pitch of a sound without changing its duration, or changing the duration of a sound without changing its pitch.

The signal processing literature shows incessant invention in the domain of spectrum analysis, driven by a wide range of goals. Thus it is notable that this one technique – the phase vocoder – has sustained iconic status nearly half a century after its initial conception. The papers in this special issue bear witness to its ongoing importance and situate in the context of ongoing research to extend its quality and range of applications.

Nota sul numero 6 (2012) di Musica/Tecnologia

Nei ringraziamenti presenti nel precedente numero di Musica/Tecnologia a pagina 17 segnalo la seguente imprecisione: Maddalena Novati, Giovanni Belletti e Alberto Zanon della RAI di Milano non erano affiliati allo Studio di Fonologia della RAI, chiuso il 28 febbraio 1983; infatti Maddalena Novati era responsabile dell'Archivio dello Studio di Fonologia della RAI di Milano, mentre Giovanni Belletti e Alberto Zanon facevano parte del Laboratorio Audio della RAI di Milano.