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TECHNICOLOR SOUND FIELD FORMAT

Technicolor Sound Field Format

The sound field format as provided by Technicolor is based on Higher Order Ambisonics (HOA). HOA content consists of a certain number of channel signals, where each channel signal contains a time-domain HOA real coefficients signal, called HOA component, i.e. $b_n^m(t)$.

The sound field description (SFD) is given by

$$p(k, r, \theta, \phi) = \sum_{n=0}^N \sum_{m=-n}^n i^n B_n^m(k) j_n(kr) Y_n^m(\theta, \phi) \quad (\text{SFD})$$

The time-domain HOA real coefficients are given by $b_n^m(t) = i\mathcal{F}_t \{ B_n^m(k) \}$. $i\mathcal{F}_t \{ \}$ denotes the inverse time-domain Fourier Transformation where $\mathcal{F}_t \{ \}$ corresponds to $\int_{-\infty}^{\infty} p(t, \mathbf{x}) e^{-i\omega t} dt$.

The number of the HOA coefficient channels grows with the Order N of the HOA content and is equal to $(N + 1)^2$.

A HOA renderer provides output signals dedicated to driving loudspeakers arrangement.


For other information concerning the HOA format (including Near Field pre-Compensation, NFC), please refer to [1].

HOA Metadata & Interpretation

The Metadata include the following information:

- N denotes the item HOA order
- A flag indicating the presence/absence of Near Field pre-Compensation (NFCon/NFCoff)
 - NFCflag=[1|0];
 - § 1: NFC information present
 - § 0: no NFC information
- NFC Reference Distance [in m] if applicable
 - NFCrefDist = xxx;
 - § distance in meters

The following conventions apply for the HOA content:

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- Azimuth of 0° means front, (positive values go to the left w.r.t the frontal direction, i.e. mathematically positive).
- Use of real Spherical Harmonic functions
- The normalization convention used is N3D
- The Condon-Shortley Phase is not used (no $(-1)^m$ term in associated Legendre functions of the Spherical Harmonics)
- The sound speed is set to 343 m/s.

The ordering of the HOA components is done according to ISO/IEC 14496-11/2005. This is shown in Table 1, where $n\mu \pm$ denotes the HOA component with n the order index (single digit), $\mu = \text{abs}(m)$, $\pm = \text{sign}(m)$, m the azimuthal frequency index (single digit).

| Index | Component $n\mu \pm$ |
|-------|-------------------------|
| 1 | 00+ |
| 2 | 11+ |
| 3 | 11- |
| 4 | 10+ |
| 5 | 22+ |
| 6 | 22- |
| 7 | 21+ |
| 8 | 21- |
| 9 | 20+ |
| 10 | 33+ |
| 11 | 33- |
| 12 | 32+ |
| 12 | 32- |
| 14 | 31+ |
| 15 | 31- |
| ... | $< n > < \mu > < \pm >$ |

Table 1 – Ordering of HOA components

Cinema Experiences

The Technicolor Sound Field Format has been tested and evaluated in various movie theater sites. In particular the Technicolor Interoperability Test Center (ITC) in Burbank has a movie theater where the format was tested. We did comparisons using a conventional 7.1 surround sound system and experimental loudspeaker installations for 3D sound, having up to 36 loudspeakers. On other movie theater sites already installed Auro 3D layouts were used for playback.

References

- [1] ISO/IEC 14496-11/2005. – MPEG-4 Part 11: Scene description and application engine