Digital Signal Processing for Music

Part 2: Introduction

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introduction
digital technology

- examples of everyday digital (audio) technology
  - **music listening**:
    - ▶ audio compression
    - ▶ audio storage and streaming
    - ▶ equalization and loudness adaptation
    - ▶ . . .
  - **music production and synthesis**
    - ▶ recording and editing
    - ▶ effects
    - ▶ denoising
  - **human computer interaction**
    - ▶ speech recognition
    - ▶ text-to-speech
  - . . .

introduction
release of digital technology — production

Product	Year
Sound Synthesis	
NED Synclavier Synthesizer/Sampler	1979
Fairlight CMI Synthesizer/Sampler	1979
Linn LM-1 Drumcomputer/Sampler	1980
E-MU Emulator I Sampling Keyboard	1981
Yamaha DX-7 Syntheziser	1983
Sound Processing/Effects	
Lexicon Delta-T 101 Digital Delay	1971
EMT 250 Digital Reverberation	1976
Lexicon L224 Digital Reverberation	1978
Sound Editing	
Sony DAE-1100 Digital Audio Editor	1980
Sony DAE-3000 Digital Audio Editor	1987
Sonic Solutions Harddisk Editing	1988
Other	
MIDI Standard	1983

introduction
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introduction
release of digital technology — production

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introduction
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introduction
release of digital technology — storage & consumer

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Digital Storage	Year
Professional	
PCM-1600 (U-matic)	1978
PCM-1 (Betamax)	1978
Digital Multitrack (3M, Sony)	1978
Alesis ADAT	1991
Tascam DA-88	1993
Consumer	
Compact Disc	1982/83
Digital Audio Tape (DAT)	1987
MiniDisc	1991
Digital Compact Cassette	1992
DVD-Video	1997
DVD-Audio	1999
SACD	1999

introduction
release of digital technology — storage & consumer

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introduction
reasons for digital equipment

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- **storage**:
  - lossless copying and archiving of digital content

- **editing & processing**
  - splicing of recordings
  - fast convolution
  - granular processing/time-stretching/pitch-shifting

- **technical characteristics**
  - SNR, distortion, transfer functions, ...

- **dropping prices** for digital hardware and software (compared to analogue equipment)

introduction
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introduction
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introduction
current trends & developments

- **resolution and data rates**
  - lower data rates for compression formats

- **audio formats**
  - multichannel & WFS, 3D acoustics in general
  - object-based audio

- **production environments**
  - online collaboration/musicianship
  - machine musicianship

- **software**
  - machine listening: music recommendation systems, etc.
  - signal- and user-adaptive audio production software
  - computer-aided editing, composition, and performance systems
  - interactive and creative audio consumer software

introduction
current trends & developments

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relation to class context

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- ■ in this class, we will learn the basics of
    - **digitizing** an analogue signal
    - **transforming and analyzing** a digital signal
    - **processing** a digital signal
    - **applying standard effects** to a digital signal
    - **encoding and decoding** a digital signal