Symmetrical SSC in SAS-2 physical interface

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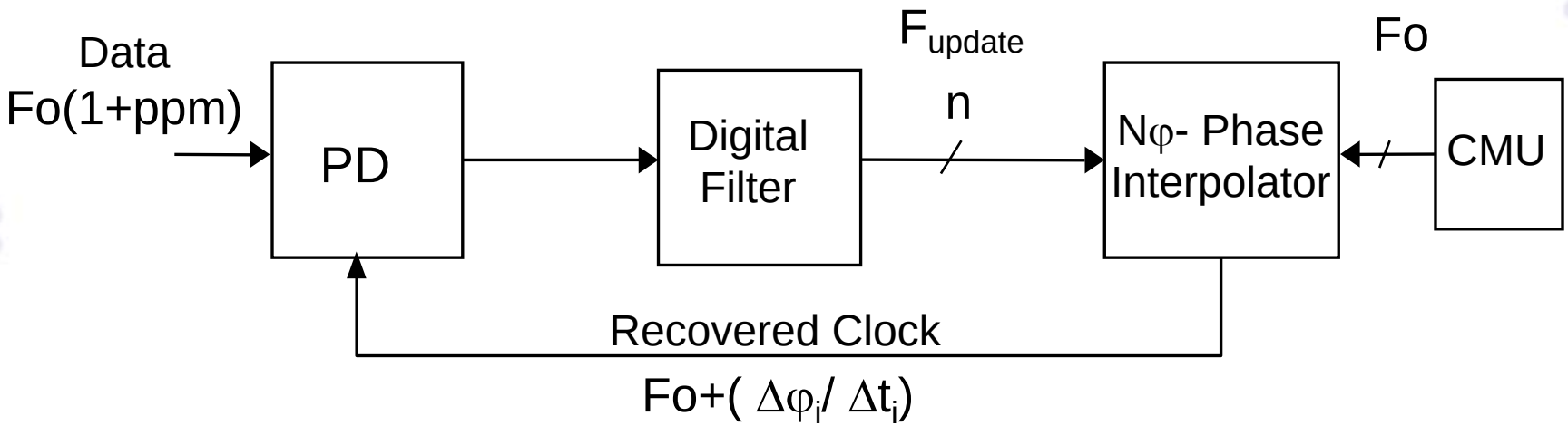
T10/06-193r0

Background

- Spread-spectrum clock (SSC) modulation in SATA is down- spreading from 0 to –5000 ppm maximum. In SAS-2 new SSC modulation profile is under debate
- Symmetrical SSC is an attractive option for SAS-2 due to better ppm tracking range and receiver jitter tolerance
  - Relevant for clock recovery with digital phase interpolation - dominant technique in multi-channel physical interfaces
- This presentation explains why symmetrical SSC allows to double the ppm tracking range in digital clock and data recovery

Digital CDR with Phase Interpolation



- Maximum frequency modulation supported by phase rotation (jitter free condition)

$$ppm_{MAX} = \pm (F_{update}/N\varphi \cdot Fo)$$

Where: Fo - 6GHz in SAS-2;

Nφ - number of phases, typically 16-64

The +/- range comes from the fact that the **phase rotation is bi-directional**

Symmetrical SSC vs. Down-spreading

- Down-spreading exploits half of the interpolator capacity in tracking the frequency modulation
  - Can’t be overcome by “centering” the phase interpolator
- Symmetrical SSC “naturally” fits phase interpolator ability for bi-directional tracking of data frequency modulation
  - Allows to double the ppm range for same interpolator design
  - Improves jitter tracking ability for same ppm range
- Data rate with symmetrical modulation averages to nominal value, thus may beneficial for data rate alignment mechanism

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